Vol. 9, No. 17
September 15, 1984

Energy Research Abstracts

Abstracts 32441-35012

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $5.00, foreign $6.25 per copy; annual cumulative index, domestic $16.00, foreign $20.00 per copy. The annual subscription price is $72.00 for domestic subscribers and $90.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

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***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB84-913500**

Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information, Technical Information Center (TIC) cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Office of Scientific and Technical Information, Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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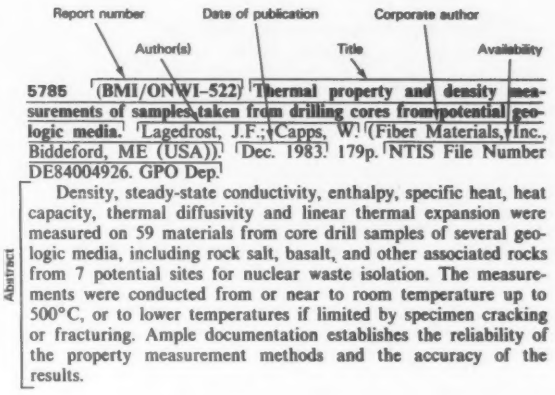
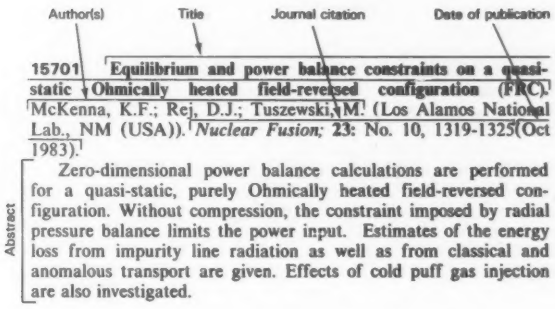
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R:US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J:US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A File Number–Report Number Correlation is included for convenience.

BMI/ONWI-522 9:5785 **NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70**

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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REFER ALSO TO CITATION(S) 32543, 32554, 32555, 32556, 32557, 32558, 32566, 32609, 32611, 33023, 33775, 33807, 33809

32441 (CAPE—2938) H-Coal Pilot Plant. Final report. Volume X, 13.0 P and IDs (Microfilm) (Engineering Materials). 20 Feb 1984. Contract AC05-76ET10143. TIC, PO Bx 62, Oak Ridge, TN 37831. Order Number TI84012305.

85 35-mm aperture cards.

Volume X of the H-Coal Pilot Plant Final Report is devoted entirely to Piping and Instrument Diagrams and is comprised of the following section: 13.0 P and IDs (Microfilm). This section contains all of the nonproprietary Pilot Plant Piping and Instrument Diagrams. These are presented in microfilm form on 35-mm aperture cards for easy reference. Table 13-1 provides an index of the P and IDs, separated by Plant areas, as follows: 100 Area - Coal Handling and Preparation; 200 Area - Coal Hydrogenation; 400 Area - Off-Site (Utilities); and 600 Area - Waste Oil Recovery. Additional Final Report reference material, such as an overall detailed index, a bibliography of H-Coal related reports and an equipment list, is presented in Volume I, Section 2.0.

32442 (CONF-8311150—Summs.) Proceedings of the fifth meeting on basic heterogeneous catalysis surface science research. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Mar 1984. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013676.

From 5. DOE/BES meeting on basic heterogeneous catalysis surface science research; Gaithersburg, MD, USA (7 Nov 1983).

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This document consists primarily of 46 project summaries, giving research scope and objectives, description of research effort, and future research. Topics include CO hydrogenation, zeolites, coal liquefaction, methane oxidation, methanol synthesis and conversion, carbon gasification, etc.

32443 (CSIRO-DFF-IR—140) CSIRO flash pyrolysis project: compendium of data. Edwards, J.H.; Smith, I.W.; Tyler, R.J. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Fossil Fuel). 1983. 35p. Commonwealth Scientific and Industrial Research Organization, Div. of Fossil Fuel, North Ryde, Australia.

A description is given of the CSIRO experiment for the production of liquid fuels by the flash pyrolysis of coal. The reaction system involved pyrolysers, tar hydrogenators and char combustors, both at the laboratory and process development unit scale. Data are given on the properties and pyrolysis behaviour of all coals pyrolysed, and on the yield and properties of the solid, liquid and gaseous products of pyrolysis. Results are reported, or indicated, from support studies for: the combustion and gasification reactivities of char, the kinetics of coal pyrolysis, the secondary pyrolysis of chars, and the nature of cracking and coking control of tars.

32444 (DOE/ET/10137—T8) Gasification of residual materials from coal liquefaction. Type III extended pilot plant evaluation of a pelletized and ground Kerr McGee mineral ash residue from SRC-I coal liquefaction process. Wu, C.M.; Robin, A.M. (Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.). Feb 1984. Contract AC01-76ET10137. 66p. (FE—2247-35). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013199.

A Type III extended pilot plant evaluation of pelletized and ground Kerr McGee mineral ash residue, which was obtained from the liquefaction of Illinois No. 6 coal at the SRC-I coal liquefaction process pilot plant at Wilsonville, Alabama, was successfully completed at Texaco's Montebello Research Laboratory (MRL). A total of 60 tons of residue was gasified during three runs which were carried out at 950 psig in the MRL High Pressure Solids Gasification Unit II gasifier. The oxygen-to-residue ratio was varied to determine optimum operating conditions. The runs lasted from 6.9 hours to 56.3 hours and a total of 72.9 hours of on-stream time was accumulated. This work was authorized by DOE Delivery Order Number 9 under DOE contract DEAC-01-76ET-10137. It is part of a continuing project to evaluate residual materials from various DOE sponsored coal liquefaction projects to determine their suitability for conversion to hydrogen using one of the Texaco gasification processes. 5 figures, 5 tables.

32445 (DOE/ET/10137—T10) Gasification of residual materials from coal liquefaction: Type II preliminary pilot plant evaluation of SRC-I extruded Kerr McGee mineral ash residue-water slurry. Wu, C.M.; Robin, A.M. (Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.). May 1984. Contract AC01-76ET10137. 30p. (FE—2247-34). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013525.

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A Type II preliminary pilot plant evaluation of SRC-I Kerr McGee mineral ash residue as a water slurry feed to the Texaco Coal Gasification Process was conducted at Texaco's Montebello Research Laboratory (MRL). The residue was obtained in the extrudate form directly from the Critical Solvent Deashing process at Wilsonville, Alabama. Approximately 16 tons of residue were gasified during three test runs which were carried out at 950 psig in MRL's High Pressure Solids Gasification Unit I. The runs lasted from 4.8 hours to 7.2 hours, and a total of 19.1 hours of on-stream time was accumulated. This work was authorized by DOE Delivery Order Number 10 under DOE contract EX-76-C-01-2247 and amendment DEAC-01-76ET-10137. It is part of a continuing effort to evaluate residual materials from various DOE sponsored coal liquefaction projects to determine their suitability for conversion to hydrogen using one of the Texaco gasification processes.

32446 (DOE/ET/10328—1628) Advancement of flash hydrogasification. Quarterly technical progress report, January-March 1984. Falk, A.Y. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 25 Jun 1984. Contract AC21-78ET10328. 91p. (ESG-DOE—13432). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013151.

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This first quarterly report documents technical progress during the period 31 December 1983 through 30 March 1984. The technical effort is 17 months in duration and is divided into two major technical tasks: Task VII, Hardware Fabrication and PDU Modifications, and Task VIII, Performance Testing. The design of test hardware and process development unit modifications had been

previously completed as part of Task VI of the current contract. Task VII involves the fabrication of test hardware and modification of an existing 1-ton/h hydroliquefaction PDU at Rockwell's facilities for use as a hydrogasifier test facility. During this report period, fabrication of the test hardware and modifications to the PDU were initiated. Test hardware fabrication is now approximately 80% complete and should be completed by the end of May 1984. PDU modifications are progressing well and should be completed by the end of June 1984. The completed test hardware fabrication and PDU modifications will allow the conduct of short duration (1 to 2 h) hydrogasification tests along with preburner assembly performance evaluation tests in order to fulfill the test program objectives. Separate supplies of hydrogen, oxygen, methane, carbon monoxide, and water (for steam generation) are provided for this purpose. The modified facility is designed to accommodate both 10- and 20-ft-long hydrogasifier reactors so that residence times will be in the range of 2 to 6 s when coal is fed at a nominal 1/2 ton/h into reactors at 1000 psia pressure. Provisions are being made for real-time analysis of the product gases using an on-line gas chromatograph system. Test planning was the only Task VIII effort active during this report period. An initial (preliminary) test matrix has been defined. Preparation of a data analysis plan is underway, and data reduction programs are being programmed. 17 references, 25 figures, 6 tables.

32447 **(DOE/ET/10633—T1) Electrochemical disposal of hydrogen sulfide. Final report, August 31, 1977-September 30, 1982.** Angus, J.C.; Landau, U.; Feke, D.L.; Gregory, T.D.; Kehr, P.M. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Chemical Engineering). 20 Sep 1982. Contract FG01-77ET10633. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013670.

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The electrolysis of hydrogen sulfide to elemental hydrogen and sulfur was investigated as a means for hydrogen sulfide disposal. Both the electrolysis of liquid hydrogen sulfide and the electrolysis of aqueous hydrogen sulfide solutions were investigated. The first reported electrolysis of liquid hydrogen sulfide was accomplished. However, the overpotential arising from ohmic losses in the hydrogen sulfide are extremely high. Unless better supporting electrolytes can be found, this method does not appear to be a practical means for hydrogen sulfide disposal. The electrochemical oxidation of aqueous hydrogen sulfide solutions was investigated and found to be a more promising approach. It was found that a sulfur film did not form on the anode in either a cell using a continuous flow of electrolyte or in a cell employing a fluidized bed anode. In both types of electrolysis the products were found to be elemental hydrogen and elemental sulfur. This is a desirable result because these products have significant economic value and, furthermore, sulfur is very easily stored. Further work should be directed towards finding much better electrolytes for use with liquid hydrogen sulfide and towards an experimental and economic study of the use of fluidized bed anodes for the electrolysis of aqueous hydrogen sulfide solutions. 10 references, 21 figures.

32448 **(DOE/ET/13046—T83) Industrial fuel gas plant project. Phase II. Memphis industrial fuel gas plant. Final report.** (Memphis Light, Gas and Water Div., TN (USA)). 1983. Contract AC02-77ET13046. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84011682.

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The Industrial Fuel Gas Plant produces a nominal 50 billion Btu/day of product gas. The entire IFG production will be sold to MLGW. Under normal conditions, 20% of the output of the plant will be sold by MLGW to the local MAPCO refinery and exchanged for pipeline quality refinery gas. The MAPCO refinery gas will be inserted into the Memphis Natural Gas Distribution System. A portion (normally 10%) of the IFG output of the plant will be diverted to a Credit Generation Unit, owned by MLGW, where the IFG will be upgraded to pipeline quality (950 Btu/SCF). This gas will be inserted into MLGW's Natural Gas Distribution System. The remaining output of the IFG plant (gas with a gross heating value of 300 Btu/SCF) will be sold by MLGW as Industrial Fuel Gas. During periods when the IFG plant is partially or totally off-stream, natural gas from the Memphis Natural Gas Distribution System will be sent to an air mixing unit where the gas will be diluted to a medium Btu content and distributed to the IFG customers. Drawing 2200-1-50-00104 is the plant block flow diagram showing the process sequence and process related support facilities of this industrial plant. Each process unit as well as each process-related support facility is described briefly.

32449 **(DOE/FE/60181—58) Effects of start-up solvent on composition of recycle liquefaction product slurry from low-rank coal.** Timpe, R.C.; Farnum, S.A.; Miller, D.J.; Wolfson, A.C.; Rindt, J.R.; Potts, Y.R. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 18p. (CONF-840805—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009231.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

As part of the on-going research in the liquefaction of low-rank coal, the University of North Dakota Energy Research Center (UNDERC) carried out two bottoms recycle runs. The purpose of these 40 pass runs was to investigate the effect of two different start-up solvents on the composition of the product from pass to pass, especially the bottoms portion used as recycle solvent, and the final lined-out composition of the product. Runs 101 and 103 were carried out in the bottoms recycle mode in the Continuous Processing Unit (CPU). Zap, North Dakota lignite from the Indian Head mine was introduced at 5 lbs/h as a 30% slurry (wt % as-received coal) in recycle feed with H_2S addition in both runs. The nominal temperature was 440°C and the nominal pressure was 4000 psig H_2/CO (95/5). The startup solvent for Run 101 was a typical anthracene oil, A04. Run 103 was started up with a Process Development Unit (PDU) recycle solvent obtained from the University of North Dakota Chemical Engineering Department's Project Lignite. The PDU solvent was derived from Zap, North Dakota Indian Head lignite. The liquefaction products were examined from pass to pass in order to follow the compositional changes as the reaction proceeded toward steady-state composition (lineout) and to determine whether the products were chemically the same for both runs after 40 reactor passes. The preliminary characterization of the separated heavy products and their composition as compared with the composition of the oils are the focus of this report. Changes in the startup solvent as it reacts with coal and is diluted by coal-derived products are discussed with emphasis on the heavy components. Differences between the two runs started up with different solvents are described. 7 references, 5 tables.

32450 **(DOE/FE/60181—72) Cleavage of aromatic carbon-carbon bonds.** Kline, E.A.; Teichert, W.P.; Farnum, B.W. (Tennessee Technological Univ., Cookeville (USA). Dept. of Chemistry; North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 9p. (CONF-840805—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010161.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

The search for a model substrate to use in evaluating relative reactivity of H-donors, under coal liquefaction conditions has led to this study of o-terphenyl. Results of cleavage reaction studies with o-terphenyl show that o-terphenyl couples in the presence of model H-donors and many coal derived solvents to form triphenylene, and forms biphenyl by cleavage. The latter reaction is of more interest as the yields are substantial, and the yields have application to the study of properties of solvents. Attempts to elucidate the mechanism involved kinetic studies, and reaction with a deuterated H-donor. The best mechanism appears to be that in which the low steady-state concentration of reactive H-donor attacks either ipso position in o-terphenyl followed by cleavage. This mechanism is known to occur at high temperatures. 7 references, 3 tables.

32451 **(DOE/FE/60181—81) Changes in asphaltenes and preasphaltenes with reaction conditions and effects on coal structure.** Knudson, C.L.; Baltisberger, R.J.; Woolsey, N.F.; Willson, W.G. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Mar 1984. Contract FC21-83FE60181. 17p. (CONF-840805—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010164.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

Asphaltene and preasphaltene data are presented to demonstrate the effect of temperature, pressure, and reducing gas composition on their hydrogen and phenolic content. The previous paper by Baltisberger showed how the hydrogen and phenolic content of the A and PA defined whether or not a coal derived product will be classified as such. The influence of processing parameters as discussed in this paper indicates that reduction in the number of phenolic functional groups and cracking are required to further convert asphaltene and preasphaltene material to distillates. That alcohol groups are present in aromatic bridging structures is indicated in the data in this report by the decreased MW of SR when processed with CO present since after hydrogenation an aliphatic bridge would cleave easier. The increased aliphatic hydrogen content in the asphaltene fraction when reacted with CO may also indicate that some alcohol groups were initially in the aromatic bridges. The presence of alcohol groups in long chain aliphatics is indicated because increased yields of long chain alkanes were observed when CO was present. The previous data have shown how operating conditions such as pressure and temperature affects the hydrogen content, phenolic content, and molecular weight range of asphaltene and preasphaltene fractions. The effects are reflected similarly in individual MW fractions of both A and PA material. The presence of alcohol groups in original coal (both lignites and bituminous coals) is strongly suggested. The preferential reaction of these alcohol groups with CO gas (but not H_2) to increase the hydrogen content of the asphaltenes, to reduce the overall MW distribution of coal, and to increase yields of alkanes indicates the beneficial effects of CO as a reductant of these functional groups which are present in both lignites and bituminous coals. 20 references, 8 figures.

32452 **(DOE/FE/60181—85) New iron oxide catalyst reduction activities with hydrogen sulfide and hydrogen.** Hattori, H.; Jones, F.A.; Ogawa, T.; Knudson, C.L.; Radonovich, L.J.; Stenberg, V.I. (North Dakota Univ., Grand Forks (USA)). 1984. Contract FC21-83FE60181. 10p. (CONF-840805—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009700.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

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Various types of catalysts have been used for coal liquefaction. Among these catalysts, molybdenum and iron catalysts are most frequently used and they are usually combined with other metal oxides. Molybdenum catalysts, in the form of $Co/Mo/Al_2O_3$ wherein this notation represents some form of the metal oxides and the last species is the support, have been used in the H-Coal process. In others, iron catalysts have been used in the form of red mud which is mixed with elemental sufur. The activity of iron catalysts has generally been regarded as low when compared with xhat of molybdenum catalysts. However, iron oxide catalysts became highly active for the conversion of coal-related model compounds when used in the presence of H_2S and H_2. For coal liquefaction in the absence of a heterogeneous catalysts, the use of a mixture of H_2S and H_2 instead of H_2 resulted in an increase in conversion. Because of the interaction of H_2S with Fe_2O_3 and the fact that iron is presently the lowest cost transition metal, iron was selected as the basis metal for a new set of heterogeneous catalysts specifically designed for coal liquefaction using the H_2S-H_2 reducing gas medium. The catalysts were subjected to two reactions: hydrocracking of diphenylmethane to toluene and benzene, a model compound for the Ar-C bond cleavage of the coal structure, and hydrocracking of diphenyl ether to phenol and benzene, a model compound for the Ar-O bond cleavage of the coal structure. The reaction conditions for these reactions are summarized in Table 2. 4 references, 2 tables.

32453 **(DOE/LC/10977—1482) High resolution seismic survey of the Hanna, Wyoming underground coal gasification area.** (Emerald Exploration Consultants, Inc., Austin, TX (USA)). Aug 1983. Contract AC20-83LC10977. 87p. NTIS, PC A05/MF A01. Order Number DE84000308.

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In June 1983 a high resolution seismic survey was conducted at the Department of Energy, Laramie Energy Technology Center's underground coal gasification test site near Hanna, Wyoming. The objectives of the survey were to locate and characterize underground burn zones and to identify shallow geologic faults at the test site. Seismic data acquisition and processing parameters were based upon prior work in the area, and were specifically designed to emphasize reflections at the shallow, 61 to 91 meter (200 to 300 ft) depths of interest. Data were obtained on two north-south lines along the test site boundary in addition to a three-dimensional grid over the Hanna IV experiment area. Processing included time varying filters, deconvolution, trace composition, and three-dimensional areal stacking of the data in order to identify burn zone anomalies. Anomalies were discernable resulting from the rubble-collapse void above the burn zones in the vicinity of the injection wells at the Hanna IV experiment area. The fault studies disclosed faults at the Hanna IV experiment area which may be responsible for the unexpected problems experienced in the early in-site gasification tests. For the test site the fault system was found to be a generally arcuate east-west trending graben complex with numerous antithetic faults. 15 references, 33 figures, 6 tables.

32454 **(DOE/MC/10526—1609) Kinetics of coal gasification reactions at process conditions. Final technical report.** Gardner, N.C.; Zheng, C.; Pehmoeller, D.; Gorecka, B. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Chemical Engineering). Jan 1984. Contract AC21-80MC10526. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013652.

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An entire fixed bed coal gasification reactor is suspended from a large analytical balance for thermogravimetric measurement of the reaction rate. This thermobalance has advantages over the hanging basket types in that sample size can be larger, thermocouples can be embedded directly in the reacting bed, and there is more control over extraparticle mass transfer resistance. Steam gasification of a North Dakota lignitic coal was studied at pressures from 20 to 33 atmospheres and temperatures from 720 to 900°C. The observed reaction order was close to one. The gasification rates were essentially independent of the measured temperature. The suggested explanation for this behavior was that the particles act collectively, giving a large resistance to mass and heat transport. The reaction took place under a strong diffusional control. Gas chromatographic analysis of the products indicated that the carbon-steam reaction is the principal gasification mechanism. Steam was in excess, and the products underwent the water-gas shift reaction. Hydrogasification studies were complicated by the observation of an ignition phenomena in the coal bed when the exothermic heat of reaction could not be removed fast enough. An expression for the temperature dependence of the reaction rate was determined. 6 references, 28 figures, 9 tables.

32455 **(DOE/MC/14593—T9) Mechanism of catalytic gasification of coal char. Quarterly technical progress report No. 13, 1 January-31 March 1984.** Wood, B.J.; Tong, G.T.; Wise, H. (SRI International, Menlo Park, CA (USA)). 1 Jun 1984. Contract AC21-80MC14593. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014086.

Experiments are being performed to optimize the conversion of NaCl in the presence of carbon to an active steam gaification catalyst. During the past quarter we examined the effect on conversion of a pretreatment process in which NaCl-impregnated char is heated in a steam-CO^2 mixture at high space velocities. The addition of CO_2 to the pretreatment gas produces a significant enhancement in gasification activity, approaching that produced by a superior catalyst such as Na_2CO_3. 3 figures, 1 table.

32456 **(DOE/MC/19403—1544) Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants. Topical report, October 1982-December 1983.** Anderson, G.L.; Berry, F.O.; Gross, M.N. (Institute of Gas Technology, Chicago, IL (USA)). Jun 1984. Contract AC21-82MC19403. 151p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84003083.

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This report summarizes the results of recent laboratory-scale studies conducted by IGT in support of (1) the development of the IGT mixed metal-oxide process for high temperature fuel gas desul-

furization and (2) the development of a high capacity, mass producible sorbent for the removal of HCl from high-temperature coal gases. The IGT mixed metal-oxide process is a conceptual process that removes sulfur-containing compounds from coal-derived fuel gases by contact with a multi-component reactive mixture of metal oxide sorbents. The objective of the process is to maximize the percentage of elemental sulfur formed during regeneration of the mixture with air and to minimize the formation of SO_2. The metal oxide sorbents tested included a cobalt oxide-silica, manganous oxide, iron oxide/chromia, iron oxide/silica, cobalt titanate, and zinc oxide. Based on the tests, the cobalt titanate, zinc oxide, and cobalt oxide/silica sorbents have been selected for further testing in a bench-scale unit. The HCl removal sorbent being developed by IGT is based on the use of a reactive moltent mixture of either lithium and sodium carbonates or lithium and potassium carbonates contained within an inert, porous ceramic matrix. The sorbent is prepared by a technique developed by IGT for the production of a similar media used for high temperature thermal energy storage. The results of the present study indicate that this preparation procedure is viable and results in a highly reactive, high capacity sorbent for HCl removal. Mass produced pellets containing 60 vol % of a molten alkali carbonate mixture (52 mol % Li_2CO_3/48 mol % Na_2CO_3) and 40 vol % MgO were found to be able to reduce the HCl content of a gas containing 99% CO_2, 3000 ppM H_2O and 400 ppM HCl to about 0.75 ppM HCl at a space velocity of 1000 h^{-1}, 600°C and atmospheric pressure. 11 references, 29 figures, 47 tables.

32457 (DOE/METC—84-8, pp 16-28) **Studies of initial reaction steps in the gasification of coal and selected model compounds.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract FG22-81PC40792.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

Considerable effort has gone into the design and construction of the new matrix isolation apparatus as well as the transient pulsed flow small particle coal sampling system. Initial testing of these apparatus has been completed and the new matrix isolation-FTIR system is now operational. We are presently in the process of collecting numerous experimental data from which a data base can be built. This data base will provide us with information concerning the initial reaction steps of coal gasification. Our main concern is centered on the identification of unknown intermediates and better understanding of the mechanism of tar formation. Preliminary studies on fluorinated coal samples give promising results from which information concerning the coal skeletal structure may be derived. Studies on whether the reactions of particular primary building blocks of coal lead to specific products have been initiated by adding isotopically substituted H_2O to the coal and studying the gaseous pyrolysis product distribution. Significant results are briefly discussed. 8 figures.

32458 (DOE/METC—84-8, pp 29-48) **Plasticity, agglomeration, and volatiles secondary reactions during gasification.** Howard, J.B.; Peters, W.A. (MIT, Cambridge, MA). Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19207.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to obtain improved quantitative understanding of the physico-chemical phenomena governing coal plasticity, the agglomeration of pyrolyzing particles of softening coal, and secondary or post-pyrolysis reactions of freshly generated tars under conditions pertinent to the operation of coal gasifiers. Some of the accomplishments are: design and development of a rheometer for measurement of the viscosity of coal melts at temperatures, heating rates, and reactive atmospheres pertinent to gasification process conditions have been performed; a preliminary prototype unit has been constructed and tested using a Pittsburgh No. 8 coal; data on secondary reactions of freshly formed coal pyrolysis tars were obtained using a dual chamber reactor system; preliminary studies were made on the effects of fresh char, active carbon and quartz surfaces on the secondary reactions of coal pyrolysis tars; gel permeation chromatography was used to monitor changes in the average molecular weight and the molecular weight distribution of the product tars. 14 figures, 3 tables.

32459 (DOE/METC—84-8, pp 49-58) **Coal gasification research studies.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19301.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this program is to study coal ash behavior, ash composition, and ash viscosity at various operating conditions in order to understand the mechanisms that contribute to low-melting ash and agglomeration. Seven runs of a Pittsburgh No. 8 coal char have been made in the 2-inch gasifier at 1800°F with both high (approximately 5 percent) and low (0.2 percent) oxygen concentration. The coal ash has been separated from the char for analysis of the chemical changes in the mineral matter during gasification. This separation was done with a sink-float procedure using bromoform as the liquid medium. The carbon conversions shown in Table 2 ranged from 35 to 98 percent in these runs, and at present, only preliminary petrographic analysis of the ash has been made. These results indicate: the presence of Fe_3O_4 with dispersed FeS. It is thought that FeS deposits on the reactor wall and is then oxidized; there are particles of Fe_2O_3 on the surface of clay particles. This may be due to the early formation of FeS-FeO melt or ferrous alumina silicate that is then oxidized to Fe_2O_3. 4 figures, 2 tables.

32460 (DOE/METC—84-8, pp 68-78) **Effects of inorganics and pore structure on char gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16117.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

It is the central objective of this research to distinguish the contributions to overall kinetics that are related to the pore structure from those attributable to surface reaction chemistry. To this end, a series of experiments were designed to provide data interpretation that could parallel and critically evaluate the model development. The random pore model, developed by Bhatia and Perlmutter (1980), interprets conversion data as a combination of chemical rates and structural changes, in terms of three parameters that characterize pore structure, particle size, and intrinsic kinetics. The experiments of this research provide independent information on both reaction kinetics and pore structure, thus, allowing critical tests of the model and making it possible to determine intrinsic rate constants without the interference of structural parameters. To extend the scope to include chars with significant inorganic additions, the model was also modified to describe the overall kinetics of such catalytic systems. Since the ultimate goal of modeling is understanding and prediction of both reaction kinetics and detailed structural change, experimental tests were devoted to these variables. Six char samples with different initial pore structures were generated from two coals by varying pyrolysis conditions. These chars were also impregnated with different concentrations of Na_2CO_3 and K_2CO_3 solution. Both catalyzed and non-catalyzed oxidation rates and their changes with conversion were measured with a thermal gravimeter analyzer in the temperature range of 380° to 500°C, essentially in the chemical kinetic control regime. Corresponding pore structure developments were measured by the combination of mercury porosimetry, CO_2 adsorption, and pycnometry. An atomic absorption technique was used to determine the amount of catalyst uptake and scanning electron microscopy served to visualize catalyst depositions. Results are discussed. 7 figures, 1 table.

32461 (DOE/METC—84-8, pp 79-87) **Heterogeneous kinetics of coal gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract FG22-81PC40786.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this research is to conduct fundamental experimental studies of heterogeneous gas-char reactions at high temperature and pressure (up to 1400°F, 550 psig), using transient techniques in a gradientless reactor system coupled with modulated supersonic molecular beam sampling. Past accomplishments on this project have included: (1) successful demonstration of the application of the entire apparatus and transient kinetic techniques to heterogeneous char-gas reactions via carbon dioxide gasification; (2) development of computer codes both to simulate the expected tran-

sient behavior of various carbon dioxide gasification mechanisms in the literature for model discrimination purposes and for subsequent parameter estimation; (3) char-carbon dioxide gasification studies where fundamental information was obtained from transient kinetic data regarding the mechanism, kinetic rate constants, and effective active site concentration for coconut char and New Mexico subbituminous coal char at temperatures from 680° to 770°C and pressures from 8 to 30 atm. More recent accomplishments are: (1) carbon dioxide gasification studies with lignite PSOC-623; (2) investigation of mechanism of CO inhibition of carbon dioxide gasification; (3) measurement of intraparticle mass transport properties of coal char by a new technique which is based on an extension of the transient kinetic approach; (4) and automated data logging and control of apparatus during the course of a transient experiment. 5 figures.

32462 (DOE/METC—84-8, pp 88-98) **Influence of changing particle structure on the rate of gas-solid gasification reactions.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16053.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this work is to determine changes in the particle structure of coal as it undergoes the carbon/carbon dioxide reaction ($C + CO_2 \rightarrow 2CO$). An experimental system that combines a pulse reactor with a flow-type BET apparatus will be used to study the influence of the changing solid structure on the gas-solid reaction. Approximately four of the following coals will be studied: Wyodak, Illinois No. 6, Kentucky No. 9, Wilcox lignite, Kentucky Elkhorn No. 3, Pittsburgh No. 6, Kentucky No. 11, and Kentucky No. 3. The changes in surface area and effective diffusivity with coal conversion will be determined, and an overall rate model including the effect of these changes will be developed and tested for each coal studied. Accomplishments are discussed for the following tasks: (1) data acquisition; (2) model developent; and (3) measurement of reaction rate data. 8 references, 11 figures, 1 table.

32463 (DOE/METC—84-8, pp 99-106) **Mechanism of catalytic gasification of coal char.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-80MC14593.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

In our experimental program, we used selected specimens of chars and a carbon black, and we placed major emphasis on three experimental techniques to provide information on chemical pathways and intermediates in char gasification reactions: (1) temperature-programmed reaction (TPR), which revealed the rate of formation of stable gaseous products resulting from the reaction of gaseous reactant with the coal char, as a function of temperature, mass of char, and gaseous reactant pressure; (2) high-temperature Knudsen cell mass spectrometry, which complemented TPR experiments by measuring the partial pressures of gaseous species in equilibrium with the solid char as a function of temperature and the gaseous environment; (3) in situ electronic spin resonance spectroscopy, which provided information on the chemical nature and environment of reactive species in the char under gasification conditions by evaluation of free radical concentrations and line widths. The results of our experiments have provided a sound basis for understanding the mechanism of catalyst action in the gasification of char by steam or carbon dioxide. It appears that effective catalysts are inorganic salts capable of forming a molten oxide film that spreads over the char surface. 5 figures, 1 table.

32464 (DOE/METC—84-8, pp 116-128) **Entrained-flow pyrolysis and gasification in the METC advanced gasification facility.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this program is to conduct high-temperature, high-pressure systematic studies of primary devolatilization, secondary volatiles reactions, and heterogeneous reactions at conditions pertinent to entrained gasifiers. Devolatilization is a complex phenomenon involving seven major variables, which is one reason it has defied rigorous, mechanistic understanding and modeling. Because of the number of variables involved, it is impractical to develop a matrix which systematically varies all seven. For the purposes of the Phase I test program, coal type and particle size (except for one excursion) will be held constant throughout. Of the remaining five, temperature, pressure, and residence time will be systematically varied through a series of tests while the entraining gas composition is held constant. The last variable, the particle time-temperature history, is impossible to hold constant in any experimental apparatus like the AGC entrained reactor. This is due to the inherent thermal property differences of various gases, the fact that these properties are functions of temperature and pressure, and the need to preheat gases to various levels in order to reach different reaction temperatures while maintaining essentially isothermal conditions. The proposed test program approaches this aspect by purposely varying the entraining gases and degree of preheat in the initial stages of the program so that the acquired knowledge can be used to minimize te variations in the subsequent tests. 7 references, 2 figures, 6 tables.

32465 (DOE/METC—84-8, pp 129-138) **Development of BEACON technology.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract FC21-80MC14400.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this research is to develop catalysts, reactors, and systems to utilize the unique, BEACON chemistry for the cogeneration of methane or hydrogen and combined-cycle electric power or steam from low-heating value fuel gases derived from coal, shale, or other sources. During the past year, a two fluid-bed, bench-scale reactor system (tandem system) was constructed and operated extensively with the best of our methane-forming catalysts. The successful operation of this unit marked the first demonstration of simultaneous deposition of carbon in one reactor, steam gasification of carbon in a second reactor, and transfer of carbon-rich and carbon-lean solids between the two reactors. Due to the unique fluid mechanical properties of the catalytic solids, we have been able to operate th two reactor system in a steady-state mode using very small equipment for this type of experimentation. Experimentation at a laboratory scale was concentrated on the development of catalyst modifications that would inhibit the formation of methane and enhance the formation of hydrogen during the steam gasification of deposited carbon. Twenty catalysts were screened, and two excellent candidates were obtained. These two catalysts showed very good stability and selectivity through 50 cycles of laboratory-scale carbon deposition and steam gasification. Results of this experimentation are summarized. 3 figures, 3 tables.

32466 (DOE/METC—84-8, pp 139-147) **Photo-assisted electrolysis applied to coal gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16377.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to investigate photo-assisted electrolysis of coal gasification, its detailed reaction mechanisms, and feasibilities for practical applications. Accomplishments include elucidation of oxidation mechanisms of coal slurries, and demonstration of solar radiation-assisted coal gasification employing semi-conductor electrodes. Experimental results from coal slurries oxidation, indicate that the iron ions leached out from coal are responsible for major anodic currents. The Fe(II) is electrolytically oxidized to Fe(III) at the anode, which oxidizes coal to various products including CO_2. The catalytic nature, after the electron transfer, has been proved by performing various experiments. The rate constants for the catalytic reaction have been determined for various solution catalysts under various conditions. Catalytic oxidation of coal slurries was shown to be a rate determining step. Catalysts such as Br_2 and Ce(IV) show at least an order of magnitude improvement in their rate constants over Fe(III). 8 references, 5 figures, 1 table.

32467 (DOE/METC—84-8, pp 148-155) **Steam pyrolysis of coal for two-stage gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81FE05123.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The present program is directed at developing a basic understanding of steam pyrolysis and generating basic engineering data so that optimum conditions for obtaining high yields of product gas in the pyrolysis stage of a two-stage gasifier can be defined. A flow system previously used at Avco to study coal combustion and slag flow was made available and modified for the steam pyrolysis studies. Modifications and shakedown have been completed and tests to establish the practical limits of operational parameters for the steam pyrolysis stage of a two-stage gasifier are in progress. Pyrolysis yields as a function of process parameters such as temperature, enthalpy, and flow rates are being investigated. Process design studies will be performed, along with the experimental studies, to be sure that the parametric levels being studied are practical as far as process systems are concerned. The test results obtained thus far show that the high pyrolysis yields obtained in a small batch reactor can be reproduced under a range of conditions in a high throughput flow reactor. The results thus support the conclusions of the Gas Research Institute (GRI) report which projects advantages of rapid steam pyrolysis and the resulting impact on gasification economics. The results also indicate that additional advantages might be realized from the use of ultra-fine coal, CO_2 as a pyrolysis media, and the injection of alkali salts for the purpose of hot gas cleaning. These process options, as well as parameters affecting the basic pyrolysis reaction, should be investigated in order that designers of advanced gasification processes can take advantage of the benefits of rapid steam pyrolysis. 5 figures.

32468 (DOE/METC—84-8, pp 156-159) **Studies toward improved techniques for gasifying coals.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-80MC14875.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

Yields of gases and liquids obtained from the pyrolysis of raw coal in steam are to be determined in laboratory-scale equipment. Liquids are to be fractionated using SESC and the fractions analyzed by elemental analysis, gas chromatography, mass spectrometry, and high-pressure liquid chromatography (HPLC) as required to characterize the liquids. A coal injection reactor was designed, constructed, and put into operation at up to 50 atm pressure and 1000°C. This reactor proved capable of accepting up to 200 mg of coal per batch and of steam temperatures adjustable to match reactor temperature. Methods for the fractionation (SESC) and analysis (elemental analysis, molecular weight distribution, boiling point distribution, and H-NMR) have been developed and/or implemented. Survey runs have been carried out identifying a promising region for operation and establishign the need for pretreatment in order to obtain high liquid yields. Following more detailed studies, the results are to be analyzed and optimum operating conditions projected for commercial operation. It has been found that: (1) high yields of liquids are obtained in the flash pyrolysis of coal in high-pressure steam, provided that coal is first pretreated by soaking in steam at elevated pressure and low temperature. Results are presented for coal pretreated in 50 atm steam at 320° to 360°C for 30 minutes; (2) the effects of pretreatment are lost if the treated sample is exposed to ambient air before pyrolysis but are retained if the sample is retained under an inert atmosphere; (3) mean molecular weight and heteroatom content decrease with increasing pyrolysis temperature. 2 figures.

32469 (DOE/METC—84-8, pp 160-168) **Flash pyrolysis of coal with reactive and non-reactive gases.** Fallon, P.; Sundaram, M. (Brookhaven National Lab., Upton, NY). Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this task is to develop a systematic process chemistry data base for the rapid pyrolysis of coal with reactive and non-reactive gases. The results of this task serve as a basis for developing and evaluating processes for the conversion of coal to liquid and gaseous fuels and feedstocks. A highly instrumented 1-inch I.D. by 8-foot long downflow entrained tubular reactor has been constructed and is available to obtain the system chemistry information. The operating conditions can range from atmospheric to 270 atmospheres, temperatures from room to 1000°C, coal flow rates from 0.10 lb to 4 lbs/hr, and gas flow rates from 0 to 20 lbs/hr. Light gas and liquid compositions are monitored continuously with an on-line process gas chromatograph. Heavier liquids, tars, and chars are collected and mass balances made. Coal particle residence times range from approximately 0.2 sec to 20 sec. The yields and distributions of all gaseous and liquid products are determined as a function of the type of coal and process gas over a wide range of temperature, pressure, and residence times, as well as coal and gas feed rates. Material balances are made for all the major constituents of the coal used and this information, plus product yield information as a function of residence times is applied to a kinetic model of the overall reaction. The data are tabulated, correlated, and presentd in reports. New process potentials are pointed out. The more important results obtained to date are discussed. 4 figures, 2 tables.

32470 (DOE/METC—84-8, pp 169-175) **Application of a cold metal reactor wall to the entrained-bed gasification of coal.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19313.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The overall objective of the program is to evaluate the feasibility of using a water-cooled metal liner in a short residence time entrained flow coal gasifier. The specific objetives are: (1) to evaluate the slagging characteristics of a water-cooled metallic reactor wall; (2) to obtain heat transfer data on the cold wall section; (3) to evaluate the effect of the cold wall section on gasifier performance; and (4) to evaluate the threshold conditions for slag adherence to the metal wall. The test program will consist of 12 gasification tests. Two types of coal, Illinois No. 6 sub-bituminous and North Dakota lignite, will be used in order to evaluate shedding characteristics of the cold wall section with two types of coal and ash. The first two tests were run to determine the operating characteristics of the gasifier with the cold wall section in place. The next three tests were made at different oxygen-to-coal ratios with Illinois No. 6 coal. Results are discussed. Two tests are now planned to attempt to determine the threshold conditions for slag adherence to the metal wall, by changing either the coolant water flow rate or the oxygen-to-coal ratio. The next three tests will be conducted with North Dakota lignite and with three different oxygen-to-coal ratios. The last two tests will be conducted without the cold wall section in place. The coal used will be Illinois No. 6 and two oxygen-to-coal ratios used previously. This should show the effect of the cold wall section upon the performance of the gasifier. 4 figures.

32471 (DOE/METC—84-8, pp 179-182) **Testing evaluation and validation of detailed mechanistic computer codes for fluidized-bed gasifiers.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19265.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

Two large, time dependent, hydrodynamic codes have been developed by the Department of Energy to provide insight into localized phenomena, to be used in solving specific scale-up and design problems and to provide information for phenomenological models. These codes, FLAG (JAYCOR) and CHEMFLUB (S-Cubed), have been previously developed to the stage where the models were defined, the FORTRAN codes were operable on VAX and IBM computers, and limited validation studies have been performed. The purpose of this 2-year contract is to test, evaluate, and validate both of these codes. This describes the program and its justification, discusses the results from the first tasks, and describes the possible impact of the program on the development of coal gasification technology.

32472 (DOE/METC—84-8, pp 183-190) **Coal gasification research studies.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19301.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this work is to determine the effect of system pressure and system temperature on bubble characteristics in fluidized bed. Building of the pressure probes for bubble measurement is completed. The exact configuration of the pressure probe and the data acquisition hardware, including a digital computer, have been determined. Computer programs for data acquisition and data analysis have been developed and tested. Calibration and testing of the pressure probe in both two- and three-dimensional fluidization columns are also finished. Experimental data on the 12-inch diameter fluidization unit operating at atmospheric condition have been obtained. 5 figures.

32473 (DOE/METC—84-8, pp 191-198) **High-pressure fluidization cold model.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this study is to develop a data base for the effects of pressure on fluidization parameters. The High-Pressure Fluidization Cold Model Facility was designed to include a 61-cm pressure vessel equipped with 24 observation ports, a nitrogen supply system, and peripheral equipment. The pressure vessel was designed such that plexiglas fluidization models of diameters up to maximum of 40.6 cm could be inserted. Its design pressure was 6894.8 kPa. After a period of shakedown testing, which included the replacement of the original sight ports with better designed units, a series of fluidization velocity tests were performed using a 10.2-cm cylindrical model. After completion of these tests, photographic studies were conducted using a 20.3-cm two-dimensional model. Currently, tests are being conducted using capacitance (static) probes to study flow regimes and bubbling in a 20.3-cm cylindrical model. 4 figures.

32474 (DOE/METC—84-8, pp 191-205) **Hydrodynamical basis for scaling fluidization data on jet penetration and mixing relevant to fluidized-bed coal gasifiers.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16440.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

This is a 2-year research effort where the major objective is to develop correlations, based on existing data, that will be useful for the scale-up of fluidized-bed coal gasifiers. The project goals are to: summarize and categorize fluidization data on jet penetration and mixing relevant to fluidized-bed coal gasifiers; review the hydrodynamical theories of fluidization relevant to jet penetration and develop nondimensional relationships describing fluidization; correlate teh data on jet penetration and mixing using nondimensional parameters from the hydrodynamic theories of fluidization. A correlation of jet penetration height, using nondimensional hydrodynamic parameters, has been developed and the sensitivity of that correlation to those parameters has been established. The Froude number is the dominant hydrodynamic parameter. However, both the gas-to-solid density ratio and the Reynolds' number have important influences upon the correlation. A comparison between the correlation, the data of several investigators, and other correlations has been made. Representative comparisons are presented. Correlations of bubble velocity and bubble/cloud geometry have been developed, using a theory of bubble motion in a fluidized bed. The correlation for bubble velocity is compared with data for both isolated bubbles and slugs, excellent agreement is demonstrated. The correlation for the relative dimensions of the cloud/bubble accurately predicts available data for isolated bubbles. 4 figures, 1 table.

32475 (DOE/METC—84-8, pp 206-214) **Evaluation of mechanistic models for coal gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The prime objective of the contract is to evaluate three computer simulation models of fluidized-bed and entrained gasification reactors. The models to be tested are CHEMFLUB of System, Science, and Software (SSS) and FLAG and FLAME of JAYCOR. The models are to be tested for the soundness of their mathematical basis and numerical methods, accuracy of coding, and appropriateness of the several constitutive relations used in the models. Also, the codes are to be exercised to simulate experimental situations and results. The CHEMFLUB fluidized-bed gasification model was exercised at METC to simulate Westinghouse cold flow experiments reported by Yang and Keairns. The Westinghouse experimental setup consisted of a semi-circular transparent plexiglas column with simulated gasifier section. The experiments studied fluidization characteristics of a cenral jet injected into a gasifier section which is fluidized by background flow through char-ash separator region. The results show the bed to be sluggish and compare favorably with the experimental results in terms of jet penetration and bed expansion data. When compared with the experimental results of Yang and Keairns, the computed gas velocity distributions differ drastically both in terms of magnitude and profile shape. 8 figures.

32476 (DOE/METC—84-8, pp 215-224) **Gasification modeling support.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The purpose of this continuing study is to evaluate and utilize detailed models developed for the Advanced Gasification Project. These activities concentrated on the fluidized-bed codes, CHEMFLUB (S^3) and FLAG (JAYCOR), and the entrained codes, FLAME (JAYCOR) and PCGC-2 (BYU). This report describes the statistical analysis of a numerical simulation of bubble motion using CHEMFLUB, the Systems, Science, and Software model. 5 figures, 1 table.

32477 (DOE/METC—84-8, pp 225-237) **Prediction and measurement of entrained coal gasification processes.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16518.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The general objectives of this coal gasification program are to develop a basic understanding of the physical and chemical processes involved in entrained coal gasification and to incorporate results in a model of entrained gasification processes. Specific tasks to be performed during this contract include: (1) entrained coal gasification measurements for various coals at different pressures; (2) completion and critical evaluation of the two-dimensional coal gasification model; and (3) application of the results to industrial and METC needs. The experimental gasification tests were to incorporate improved test reliability through more uniform feeding of the coal, oxygen and steam, improved measurement accuracy of the feed rates, and improved sampling and analysis accuracy. Tests with various coal types and tests at elevated pressure were to be performed. The completed two-dimensional entrained coal gasification model was to be critically evaluated, refined, and prepared for industrial and METC use. Additional velocity and turbulence data were to be collected with the Laser-Doppler Velocimeter in the cold flow jet mixing facility. Results were to be reviewed with a Technical Advisory Committee. A data book for code evaluation was to be prepared to include detailed profile data from entrained coal gasifiers, pulverized coal combustors, gaseous combustors, and cold flow jet mixing studies. Accomplishments are presented for: (1) pulverized coal gasification measurements; (2) cold flow mixing experiment; and (3) gasifier model development. 6 figures, 1 table.

32478 (DOE/METC—84-8, pp 238-240) **Utilization of the EPRI/S^3 entrained flow coal gasification model.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to evaluate an entrained flow coal gasification computer model (developed by Systems, Science, and Software [S^3] for the Electric Power Research Institute [EPRI]) for the prediction of transient gasifier performance using a large computer code. The EPRI entrained flow (EEF) program and three subprograms were successfully compiled on the CRAY machine. Four minor programming problems were encountered, namely: use of SEGMENTATION tree, the INCLUDE command, the PARAMETER feature, and double precision arithmetic. These problems were overcome rather easily using alternative procedures at Los

Alamos. The sample problem given in the user's manual was reproduced within 2 percent of all salient variables. At present, we are trying to run a simple; cold, ideal-flow, cylindrical jet of air into air at 1 bar pressure to compare it with results from another code called SIMMER. The latter compared very well with an analytic solution. We have no results at this time because of the EEF program goes unstable very early in the calculation.

32479 (DOE/METC—84-8, pp 241-253) **Coal gasification reactions with on-line, in situ FT-IR analysis.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81FE05122.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The goal of this program is to develop the technique to characterize a raw coal with a few simple tests and use this characterization to predict the coal's behavior in a gasifier. Accomplishments include the following: (1) acquisition of a detailed set of data for rapid and slow pyrolysis for a set of coals of varying rank. Data include yields and composition of char, tar, and gas as functions of time and temperature (up to 1300°C) at 1 atmosphere; (2) development of a pyrolysis theory capable of simulating the data using a set of coal functional group parameters which depend on rank but are independent of pyrolysis apparatus and a set of kinetic rate for each functional group which depend on the functional group but are independent of coal rank; (3) demonstration of in-situ analysis of pyrolysis gases at high temperature by FT-IR; (4) development of a swelling model which is coupled to the pyrolysis model for gas evolution and coal viscosity; (5) initial application of a tar evolution model. 7 figures.

32480 (DOE/METC—84-8, pp 254-258) **Theoretical and experimental studies of fixed-bed coal gasification reactors.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract FG22-80PC30219.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objectives of this research is to develop mathematical models to get a better understanding of fixed-bed coal gasification reactors. The specific goals of the project are: (1) develop and test a laboratory fixed-bed reactor in order to generate data for validating existing models and to determine model parameters; and (2) interpret the data using dynamic models of the gasifier in order to identify sensitive parameters. Modify the model based on the observed results. Accomplishments are: (1) a one-dimensional model to describe the steady-state and transient behavior of fixed-bed gasifiers of the Lurgi type have been developed, coded into a computer program, and tested using published data; (2) a two-dimensional model which takes into account radial variations, as well as dispersion of heat, has been developed for studying the behavior of the laboratory-scale fixed-bed reactor and is now operational; and (3) construction, testing, and operation of a laboratory fixed-bed coal gasification reactor to generate temperature and composition profiles which can be used to exercise the model developed above. 1 figure, 1 table.

32481 (DOE/METC—84-8, pp 261-272) **Development of a process for the simultaneous high-temperature removal of alkali and particulates in pressurized gasification systems.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16372.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

This program is directed at performing experimental and analytical investigations, system designs, and cost estimates to ascertain the feasibility of using aluminosilicate-based getters for controlling alkali in pressurized, hot-gas cleaning systems. Its overall objective is to develop a comprehensive plan for evaluating a scaled-up verison of the gettering process as a unit operation or as an integral part of a particulate removal device. The Westinghouse program is composed of four technical tasks. These tasks are: (1) process thermodynamic projections; (2) getter selection and qualification; (3) system performance projections; and (4) program definition for concept scale-up. Tasks 1, 3, and 4 are basically analytical investigations that depend on the experimental kinetic studies to be conducted in conjunction with Task 2. Task 1 input includes phases and compounds identified by X-ray diffraction analysis of reacted getter pellets. The quantity of volatile alkali in the coal-derived fuel gas is then predicted thermodynamically. Task 3 is directed to analysis of the experimental data in three areas: kinetic modeling studies using the bench-scale and TGA system data, process modeling, and an engineering assessment of the alkali gettering system. In Task 4, input from the other tasks will be used to meet the overall objective of the program. Accomplishments for the 4 tasks are described. 4 figures, 4 tables.

32482 (DOE/METC—84-8, pp 281-291) **Low-energy process for separating hydrogen and methane in advanced coal gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-80MC14386;AC21-83MC20183.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objectives are: (1) to develop coal-based sorbents for H_2/CH_4 separation which are lower cost than activated carbon and the use of which will result in a lower energy requirement than using other sorbents or using other separation processes; (2) to gather basic information on the cyclic, fixed-bed processes, and to compare them with the moving-bed processes. Modeling of temperature and pressure swing separation will be done; (3) to develop a combined H_2CH_4 separation and pollutants cleanup process based on preferential adsorption and staged desorption; and (4) to develop pressure swing separation processes for separating $H_2/CO/CH_4/CO_2/H_2S$. Adsorption and separation of the ternary system: $H_2/CH_4/H_2S$ (with 1 percent of H_2S) has been studied and the following have been found: (a) preferential adsorption and sorbent studies; H_2S and CH_4 adsorb much more strongly than H_2 on all carbons. Montana char adsorbs equal amounts of CH_4 from CH_4/H_2 mixtures as commercial activated carbons do; (b) fixed-bed cyclic process; temperature-swing separation using activated carbon and coal char effectively separates a 50/50 mixture of H_2/CH_4 into 90/10 products. A pore-diffusion model has been developed which adequately predicts the performance of temperature-swing data and has been shown to be superior than the equilibrium models; (c) combined separation cleanup process; initial experiments are being conducted to explore the feasibility of combining the separation process with the acidic pollutants scrubbing process, using the same coal-base sorbent. 6 figures, 2 tables.

32483 (DOE/METC—84-8, pp 292-300) **Calcium silicate cement sorbent for H_2S removal and improved coal gasification processes.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to develop commercial silicate-bearing cements for in-situ desulfurization of gases and to investigate the improved (catalytic) gasification in low and medium Btu fluidized-bed gasifiers. The preparation procedure and conditions for agglomerating ACS (agglomerated cement sorbent) pellets using a drum pelletizer have been established. The 40 mm I.D. bench-scale FBG tests using simulated gas mixtures showed that these pellets have a sulfidation capacity of about 55 to 65 percent in the temperature range of 900° to 1000°C are almost completely regenerable during cyclic use. The 1-inch I.D. FBG tests performed by our collaborator, the Foster-Wheeler Corporation, using Illinois No. 6 coal indicated that greater than 95 percent sulfur removal from the fuel gas is observed the the ACS pellet in the temperature range of 800° to 950°C and at a Ca/S ratio of 2.5 to 3.0, compared to 50 to 65 percent sulfur removal for Greer limestone under the same conditions. In order to find out the reason(s) for the enhanced gasification efficiency with the ACS pellets, two sets of tests were performed of the catalytic effect of sorbents or diluents (i.e., ACS pellet, Greer limestone and sand) on the gasification efficiency of a New Mexico coal char using the 40 mm I.D. FBG. It was found that the coal char gasification either with CO_2 gas or with O_2 gas is very much enhanced in the presence of either ACS pellets or Greer limestone over the case of coal char alone. However, little difference was found between the ACS pellet and Greer limestone in the degree of enhancement of gasification efficiency. This effect for both sorbents was significantly enhanced when a small amount of H_2S gas was

introduced to carry out the sulfidation reaction with the sorbent simultaneously. 5 figures, 1 table.

32484 (DOE/METC—84-8, pp 301-312) **Acid gas removal process.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-80MC14399.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this project is to: expand the CNG acid gas removal (AGR) process data base; design and develop improved triple-point carbon dioxide crystallizer; determine the fate of trace contaminants in the CNG process; and investigate pumping of solid carbon dioxide slurries. Briefly, the CNG process removes sulfur compounds, residual trace contaminants, and carbon dioxide from synthesis gas mixtures at moderately lower temperatures and is especially suited to medium- to high-pressure (300 to 1000 psia) gas streams containing substantial amounts of carbon dioxide. Accomplishments are as follows: (1) triple-point crystallizer construction was completed in summer 1982; (2) triple-point crystallization of carbon dioxide sharply rejects hydrogen sulfide (and other contaminants); (3) fates of trace contaminants entering CNG acid gas removal process have been determined; (4) several types of pumps for pumping triple-point slurries of solid carbon dioxide in liquid organic carriers have been evaluated; (5) improved separation of carbon dioxide from hydrogen sulfide compared to the first generation CNG triple-point crystallizer has been demonstrated; (6) path of trace contaminants within the process has been defined; no difficulty is envisioned with contaminant accumulation in the process or with contaminant removal from the crude gas; and (7) minimum positive suction head for pumping bubble point slurries of solid carbon dioxide in organic liquids has been determined, the solid carbon dioxide crystals settle rapidly in quiescent slurry, but show no tendency to agglomerate and are easily resuspended. 8 figures. 1 table.

32485 (DOE/METC—84-8, pp 313-321) **Studies in tar formation and separation in coal gasification systems.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19208.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of the research program is to investigate the problem of tar formation, control, and separation, both during gasification and from the gasifier off-gas stream, in fixed-bed gasifier systems. In the present research program, the devolatilization section alone is simulated on a laboratory gasifier, with contact between coal and a synthesis gas of appropriate composition, at suitable temperatures and pressures. Next, the product gas stream is led through cracking (catalytic and noncatalytic) and condensation (wash spray quench or indirect) units. A total of 48 runs would have been completed by the time of this paper. Some of these are summarized in Tables 1 through 4. Future runs will be carried out only with Coal No. 230 (noncaking Subbituminous B Montana Rosebud) and Coal No. 1188 (medium Volatile Bituminous Illinois No. 6). Coal No. 525 (Dietz No. 3 Subbituminous B Wyoming), however, is also satisfactory for the studies while Coal No. 997 (High Volatile A Bituminous West Virginia Coal, Pittsburgh Seam) tends to cake and, hence, will not be investigated further. Additionally, a reactor operating pressure of ~ 30 psig rather than 0 psig appears more convenient for the atmospheric pressure runs, in order to cater to pressure drops across the bed and along the lines. The chars will be weighed for all runs while tars will be collected and weighed on selected runs. The tars will be analyzed for molecular weight and composition, for selected runs. The off-gases will be analyzed for selected runs. Tar scrubbing results on some runs will also be reported. 3 figures, 4 tables.

32486 (DOE/METC—84-8, pp 322-336) **Thermal reactions of aromatics with CO.** Longwell, J.P.; Williams, G.C.; Peters, W.A. (MIT, Cambridge, MA). Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract FG22-80PC30229.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to study quantitatively thermal reactions of pure aromatic compounds including phenolics in the presence of CaO, including rates, extends, and stoichiometry of the conversion reactions, effects of CaO physical and chemical properties, and CaO lifetime and activity. Applications to coal gasification including tar management, improved by-product values, pollutant control, heteroatom reduction, and selective dearomatization are of interest. The effect of calcining temperature and calcining time on the activity of CaO for the pyrolysis of polycyclic aromatic hydrocarbons was studied by determining the extent of pyrolysis of 1-methylnaphthalene over the solid at a fixed temperature (550°C) and residence time (1 s). Maximum activity of the oxide was obtained at a calcining temperature between 700° and 800°C and a calcining time of at least 3 hours. Pyrolysis of 9-methylanthracene was studied between 250° and 700°C. Below 600°C, 9-methylanthracene is thermally stable over quartz but undergoes more than 80 percent conversion over CaO. At temperatures below 400°C, the conversion of this polycyclic compound over CaO is essentially constant (~ 37 percent). This is believed to be a result of the formation of a surface complex, which leads to extensive coking at high temperatures. Although coke, anthracene, and CH_4 were the major products for pyrolysis over both CaO and quartz, the vast difference in the molar ratio of CH_4 to anthracene between the solids suggests that the pyrolysis mechanism over CaO is dissimilar to that over the more inert quartz. 11 figures, 1 table.

32487 (DOE/METC—84-8, pp 337-346) **Coal gasification and tar conversion reactions over calcium oxide.** Longwell, J.P.; Peters, W.A. (MIT, Cambridge, MA). Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-81MC16026.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to investigate, for freshly formed coal pyrolysis tars and reaction conditions pertinent to coal gasification, the effects of CaO on: (1) the selectivity of tar cracking reactions; (2) removal of phenolic and other oxygenated compounds; (3) tar global properties including viscosity, storage stability, and coking tendency; (4) gasification rate of tar cracking products, especially carbon; and (5) production of light gases and liquids. Preliminary results of coal volatiles generation and cracking experiments indicate that CaO obtained from calcining $Ca(OH)_2$ in-situ can drastically reduce the absolute yield of tars. At 700°C, about 73 weight percent of the fresh tars, generated from 1 gm of Pittsburgh seam (No. 8) bituminous coal is reacted through secondary reaction with 0.45 gm of CaO with a 0.13 sec contacting time as compared to 19 weight percent of tar removal due only to homogeneous vapor-phase thermal cracking with a volatiles residence time of 2.2 sec. The production and yields of methane, hydrogen, and ethylene gases are also significantly increased. Overall material balances generally appear to be satisfactory. Preliminary results on effects of secondary reactions on the phenolic content of fresh pyrolysis tars (by nonaqueous thermometric titration, using acetone as the thermometric indicator) are given in Table 3. The fact that about 85 to 90 weight percent of the phenolic oxygen in the original tars is removed in the presence of CaO, indicates the strong activity of CaO for interaction with phenolic functional groups in coal tars. A detailed literature review has been performed to obtain a better understanding of the unusual thermo-chemistry of CaO with organic compounds, especially aromatics. 5 figures, 1 table.

32488 (DOE/METC—84-8, pp 347-355) **Thermal and catalytic cracking of tars and tar constituents from coal gasification processes.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to investigate the tar pyrolysis for the purpose of determining the operating conditions for maximizing gas and char production. Generally, inexpensive materials are screened to evaluate their effectiveness as tar cracking catalysts. A final goal is to test kinetic models of tar cracking to generate expressions for the rate of tar pyrolysis reactions. Our results were obtained by use of a fixed-bed reactor (alonized stainless steel) with an I.D. of 2.7 cm in which the catalytic materials were packed in beds of thicknesses in the range of 1 to 6.4 cm. The residence time of the tar vapor carried by helium gas varied from 0.4 to 10 seconds. When the catalytic effectiveness of various packed beds were evaluated

and compared, the bed thickness and the residence time were, in most cases, 6.4 cm and 2.4 seconds, respectively. The pyrolysis temperature has a very large effect on the tar conversion to gases, light oils (mostly BTX), and chars. It was found that both synthetic and natural zeolites having large pore sizes (≧ 0.7 nm), large surface areas and large number of strongly acidic sites are very effective catalysts for tar converison to carbon and gases. Examples are synthetic faujasites (X- and Y-types) and natural chabazite. 5 figures, 1 table.

32489 (DOE/METC—84-8, pp 356-357) **Process development studies in coal gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AT03-79ET14883.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objectives of this work are the following: (1) the production of light hydrocarbons, principally C_1 through C_4 directly from coal in a single stage operation. Use of appropriate catalysts permits temperatures of the order of 500°C and pressures on the order to 1000 to 1500 psia, which are mild for coal gasification; and (2) steam reforming of aromatic compounds followed by steam reforming of coal-derived liquids. The products of this operation will be a source for molecular H_2, a source for synthesis gas (CO and H_2) or an ultimate high Btu fuel product. Coal has been successfully hydrogenated and hydrocracked to methane yields of 50 to 60 percent by weight of the coal at temperatures below 600°C and pressures below 1500 psi using an appropriate catalyst. Yields of 50 to 60 percent by weight of the coal at temperatures below 600°C and pressures below 1500 psi using an appropriate catalyst. Yields of 50 to 60 percent by weight, C_2-C_4 hydrocarbons have been obtained at temperatures below 500°C and pressures below 1500 psi using a different appropriate catalyst. The catalyst composition will be identified when the patent position has been defined.

32490 (DOE/METC—84-8, pp 395-407) **Steam reforming of aromatic hydrocarbons.** Chen, I.E.; Goyal, S.K.; Hanson, F.V.; Oblad, A.G. (Univ. of Utah, Salt Lake City). Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The specific objectives of the investigation were as follows: (1) to develop a catalyst of sufficient activity to reform aromatics; (2) to determine the conversion of simple aromatics as a function of the main variables (temperature, pressure, contact time, and steam/carbon ratio); (3) to determine the kinetics of the reforming reactions; (4) to determine the reaction mechanisms; and (5) to determine the feasibility of the steam reforming of heavy coal liquids to produce synthesis gas and, if feasible, investigate the effects of the main variables. It has been demonstrated that heavy coal liquids can be steam reformed to produce synthesis gas. A mechanism has been prepared for the reaction of steam and benzene. A catalyst has been developed which has high activity for steam reforming including aromatic hydrocarbons. An initial indication of the reaction kinetics for the reforming of benzene and SR II coal liquids have been derived from the data. The reactions appear to be first order with respect to aromatics and zero order for steam. Steam/carbon ratio does not appear to influence the steam-reforming reaction, provided the ratio is above the ratio for carbon formation. The results of this work show that catalysts can play a key role in the reactions of coal with steam. Blank runs with benzene showed that temperatures above 900°C are necessary for thermal steam reforming. With catalysts this reaction begins at 450°C. If some inexpensive route can be found to liquify coal, then with catalysts, it may be possible to achieve that long desired reaction: a one-step route to methane from coal and steam at low temperatures where this reaction is favored. 10 figures.

32491 (DOE/METC—84-8, pp 408-409) **Single stage catalytic gasification of coal to high-Btu gas.** Wiser, W.H. Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The usual procedure for converting coal to a high-Btu gas involves, as a first step, the reaction of coal with steam and oxygen, thereby oxidizing much of the carbon to CO. Energy equivalent, up to one-third of the heating value of the coal, is consumed in maintaining the system temperature (usually above 950°C) and sustaining the endothermic steam-carbon reaction. The subsequent water-gas shift reaction ($T < 400°C$) and reduction of a substantial portion of the CO to CH_4 ($T \sim 430°C$) are exothermic but cannot be used to support the steam-carbon reaction at a much higher temperature. This research follows an alternate path of further reducing the carbon in the coal to C_1-C_4 hydrocarbons by catalytically adding hydrogen while avoiding oxidation of carbon to CO. Temperatures are in the range 450° to 500°C, pressures 1000 to 1200 psig, and contact time 6 to 30 minutes. It has been demonstrated that appropriate selection of catalysts can dramatically affect the hydrocarbon product. It is not desirable to reveal the composition or specific types of activity of the catalysts until the patent position has been more fully define. Catalyst A was selected to maximize the yield of methane in the product. Catalyst B was selected to maximize the yield of C_3-C_4 hydrocarbons with sufficient liquids production to operate in solvent balance. Typical experimental results for these catalysts are presented.

32492 **(DOE/METC/SP—206) Underground coal gasification in the bituminous coal resource.** (USDOE Morgantown Energy Technology Center, WV). Mar 1984. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84003082.

The goal of the US Department of Energy (DOE) Underground Coal Conversion Program is to develop technology to produce clean fuels from coal deposits that are unsuitable for commercial mining. DOE's strategy is to remove the high-risk elements of UCG by resolving technical, environmental, and economic uncertainties. This will enable industry to assume responsibility for commercialization of the technology. Thus, the elements of the program have been designed to: provide detailed design and operational data that industry can use to scale-up with confidence; provide accurate and complete cost estimates that will allow comparison between alternative processes; provide detailed environmental impact and control data to allow industry to implement projects that will meet applicable standards; verify the reliability of continuous operation of UCG processes; and show that UCG processes have the flexibility to meet a variety of commercial needs. The Underground Coal Conversion Program has successfully demonstrated the technical feasibility of UCG for subbituminous coals through a series of 13 federally sponsored UCG field tests. These tests have demonstrated both air and steam-oxygen injection, reverse combustion and directional borehole drilling to link process wells, and continuous operation for sufficiently long time periods (30 to 60 days) at high enough gasification rates (30 to 100 tons per day) to provide a good technical data base. A number of mathematical models have been developed and compared with field results to provide predictive capability. The need for extensive pre-operational site characterization has been demonstrated. 72 references, 5 figures.

32493 **(DOE/OR/03054—12) Final environmental impact statement/baseline design reconciliation. Final technical report.** (International Coal Refining Co., Allentown, PA (USA)). Feb 1983. Contract AC05-78OR03054. 83p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013163.

The Final Environmental Impact Statement (FEIS) for the SRC-I Demonstration Plant, published in July 1981, was based on preliminary design information available at that time. After the FEIS was published, the design continued to be revised and updated, and it evolved into a more detailed Baseline Design, which was published in March 1982. This design was subsequently upgraded by means of numerous Engineering Change Proposals (ECPs). Evolution of the Baseline Design and ECPs involved many changes that were environmentally significant. This report was prepared to highlight major changes made since the FEIS was published, and to provide a foundation upon which future updating could be based. No attempt has been made to revise the FEIS, or to provide a quantitative update of its environmental analyses. Where possible, estimates of the direction and magnitude of the changes are provided and outstanding issues that require further study are enumerated. In general, although the environmental impacts of the current SRC-I plant design differ from those in the FEIS, the releases remain well below applicable standards and comparable coal power plant

releases. FEIS worst-case analyses still encompass the potential impacts of the current design.

32494 **(DOE/OR/03054—20) Internal R and D task summary report: large-scale dissolver cold-flow modeling.** Moujaes, S.F. (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013974.

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Cold-flow simulation of the SRC-I dissolvers has been performed on three columns with different height-to-diameter ratios to provide a better understanding of the fluid dynamics and operation of a three-phase gas/liquid/solid system. The experiments were conducted in 5-in.-, 12-in.-, and 6-ft-diameter columns. The effects of various parameters on gas holdup, liquid axial dispersion coefficients, solids axial distribution, and gas/liquid mass-transfer coefficients were investigated. In general, ICRC found that flow conditions such as superficial gas and liquid velocities, physical properties of the liquid such as surface tension and viscosity, and the solids loading and particle size could dramatically affect column performance by affecting gas holdup, axial liquid dispersion, gas/liquid mass-transfer coefficients, and solids distribution. This, in turn, could affect scale-up of the dissolver to demonstration plant size. 11 references, 64 figures, 14 tables.

32495 **(DOE/OR/03054—24) Revised integration documentation.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1983. Contract AC05-78OR03054. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013521.

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Process streams and utilities interface information from the Design Baselines were compared to identify any inconsistencies that could: jeopardize process integrity; interfere with plant operability; or significantly impact the baseline cost estimates. The attached document compiles the process and utilities interface information contained in revised baselines developed by each area contractor as of December 1982 and points out discrepancies. With few exceptions, the interface discrepancies were attributable to project information upgrading inherent in the baselining effort itself. There were two major sources for discrepancy between baselines. First, essentially all baseline work was started simultaneously. Each area contractor began baselining with preliminary estimates of the requirements of the other areas. Further, start-up, shutdown, and slipstream requirements identified during baseline and P and ID development could not always be worked into the baseline of all affected areas. The second major source of discrepancies stemmed from uncertainty in technical definition at the start of baselining efforts. Most of these items have been addressed now as ECP's but understandably, they were sources of baselining inconsistencies. Two qualifications must be recognized. First, the interconnecting piping systems have not been optimized. Final line sizing will be determined during the detailed design phase of the project. To check baseline consistency, only the bases for design can be compared. The second qualification is that the utility systems must be considered preliminary. Most utility systems will undergo one or more iterations before a final optimized system is developed. While the utility distribution system can be significantly altered, the major equipment is not expected to be greatly affected by future optimization. 7 figures, 17 tables.

32496 **(DOE/OR/03054—25) Summary material balances for the 6000-TPD SRC-I Demonstration Plant.** (International Coal Refining Co., Allentown, PA (USA)). Jul 1983. Contract AC05-78OR03054. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013782.

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Terminal stream material balances for individual process areas of the 6000-tpd SRC-I Demonstration Plant have been developed. Based on these, overall plant summary material balances were compiled for the two normal operation cases, i.e., expanded-bed hydrocracker (EBH) at high conversion and EBH at low conversion. The summary balances, presented in this report, cover all streams in and out of each process unit, including utility, waste, and vent streams. Also, stream properties such as pressure, temperature, standard cubic feet per minute (scfm), gallons per minute (gpm), actual cubic feet per minute (acfm), molecular weight, density, and viscosity have been estimated. The terminal stream balances developed for individual process areas are based on information contained in Design Baselines as of December 1982. Numerous interface stream discrepancies exist among the individual area Design Baselines. Essentially all the Baseline design work was started simultaneously. Each Area Contractor began preparing his Baseline with preliminary estimates of the requirements for other areas. Furthermore, a given contractor could not take advantage of refinements in material balances made by the other contractors throughout the Baseline design period. Also, start-up, shutdown, and slipstream requirements that were identified during development of the Baseline and piping and instrument diagrams (P & IDs) could not always be worked into the Baselines of all affected areas. However, the attached summary balances have been developed on a consistent basis. All interface discrepancies have been corrected by appropriate stream adjustments to yield converged sets of material balances. Differences between these balances and the baseline are judged to be insignificant and to have negligible impact on the process design, cost or operability of the facility.

32497 **(DOE/OR/03054—29) Effects of accumulated solids and solvent initial boiling point on dissolver performance. Final technical report.** Skinner, R.W. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 166p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013645.

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Recycling mineral-rich solid residues (filter cake and Kerr-McGee ash concentrate) to the dissolver of an SRC-I coal liquefaction process is beneficial. Recycling increases the combined yield of oils plus asphaltenes, and decreases the preasphaltene yield, without increasing the hydrocarbon gas yield, without increasing the hydrocarbon gas yield. Filter cake catalyzes the preasphaltenes conversion and solvent hydrogenation reactions, indicating that dissolver solids are catalytically active. 12 references, 39 figures, 39 tables.

32498 **(DOE/OR/03054—30) Steam/fuel system optimization report: 6000-tpd SRC-I Demonstration Plant.** Vakil, T.D. (International Coal Refining Co., Allentown, PA (USA)). Jul 1983. Contract AC05-78OR03054. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013522.

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The design and configuration of the steam and fuel system for the 6000-ton-per-day (tpd) SRC-I Demonstration plant have been optimized, based on requirements for each area of the plant that were detailed in Area Baseline Designs of December 1982. The system was optimized primarily for the two most likely modes of plant operation, that is, when the expanded-bed hydrocracker (EBH) is operating at either high or low conversion, with all other units operating. However, the design, as such, is also operable under four other anticipated operating modes. The plant is self-sufficient in fuel except when the coker/calciner unit is not operating; then the required fuel oil import ranges from 80 to 125 MM Btu/h, lower heating value (LHV). The system affords stable operation under varying fuel gas availability and is reliable, flexible, and efficient. The optimization was based on maximizing overall efficiency of the steam system. The system was optimized to operate at five different steam-pressure levels, which are justifiable based on the plant's team requirements for process, heat duty, and power. All identified critical equipment drives will be run by steam turbines Also part of the optimization was elimination of the steam evaporator in the wastewater treatment area. This minimized the impact on the steam system of operating in either the discharge of zero-discharge mode; the steam system remains essentially the same for either mode. Any further optimization efforts should be based on overall cost-effectiveness.

32499 **(DOE/OR/03054—31) Hydroprocessing SRC. Final technical report.** Bronfenbrenner, J.C.; Garg, D.; Harris, C.F.; Znaimer, S. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 84p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014151.

Catalyst activity and aging rate were studied in ICRC's process development unit (PDU) and at the Wilsonville Advanced Coal Liquefaction Facility under SRC-I Demonstration Plant hydroprocessing conditions. Similar studies using both high- and low-conversion modes were conducted by The Lummus Company. The studies determined variations in SRC conversion, hydrocarbon gas production, hydrogen consumption, and heteroatom removal. Samples of spent catalyst were analyzed to ascertain the reasons for catalyst deactivation. Finally, the ICRC PDU hydroprocessing results were compared with those generated at Lummus and Wilsonville pilot plants.

32500 **(DOE/OR/03054—32) Slurry fired heater cold-flow modelling.** Moujaes, S.F. (International Coal Refining Co., Allentown, PA (USA)). Jul 1983. Contract AC05-78OR03054. 198p. NTIS, PC A09/MF A01; 1: GPO Dep. Order Number DE84013791.

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This report summarizes the experimental and theoretical work leading to the scale-up of the SRC-I Demonstration Plant slurry fired heater. The scale-up involved a theoretical model using empirical relations in the derivation, and employed variables such as flow conditions, liquid viscosity, and slug frequency. Such variables have been shown to affect the heat transfer characteristics ofthe system. The model assumes that, if all other variables remain constant, the heat transfer coefficient can be scaled up proportional to D/sup -2/3/ (D = inside diameter of the fired heater tube). All flow conditions, liquid viscosities, and pipe inclinations relevant to the demonstration plant have indicated a slug flow regime in the slurry fired heater. The annular and stratified flow regimes should be avoided to minimize the potential for excessive pipe erosion and to decrease temperature gradients along the pipe cross section leading to coking and thermal stresses, respectively. Cold-flow studies in 3- and 6.75-in.-inside-diameter (ID) pipes were conducted to determine the effect of scale-up on flow regime, slug frequency, and slug dimensions. The developed model assumes that conduction heat transfer occurs through the liquid film surrounding the gas slug and laminar convective heat transfer to the liquid slug. A weighted average of these two heat transfer mechanisms gives a value for the average pipe heat transfer coefficient. The cold-flow work showed a decrease in the observed slug frequency between the 3- and 6.75-ID pipes. Data on the ratio of gas to liquid slug length in the 6.75-in. pipe are not yet complete, but are expected to yield generally lower values than those obtained in the 3-in. pipe; this will probably affect the scale-up to demonstration plant conditions. 5 references, 15 figures, 7 tables.

32501 **(DOE/OR/03054—49) Evaluation of effects of phenol recovery on biooxidation and tertiary treatment of SRC-I wastewater. Final technical report.** Mitchell, J.W.; Watt, J.C.; Cowan, W.F.; Schuyler, S.E. (Catalytic, Inc., Philadelphia, PA (USA)). Sep 1983. Contract AC05-78OR03054. 381p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84013973.

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Addition of phenol recovery to the wastewater treatment scheme in the Baseline Design for the SRC-I Demonstration Plant was evaluated as a major post-Baseline effort. Phenol recovery affects many downstream processes, but this study was designed to assess primarily its effects on biooxidation and subsequent tertiary treatment. Two parallel treatment schemes were set up, one to treat dephenolated wastewaters and the other for processed nondephenolated wastewaters, a simulation of the Baseline Design. The study focused on comparisons of five areas: effluent quality; system stability; the need for continuous, high-dose powdered activated carbon (PAC) augmentation to the bioreactor; minimum bioreactor hydraulic residence time (HRT); and tertiary treatment requirements. The results show that phenol recovery improves the quality of the bioreactor effluent in terms of residual organics and color. With phenol recovery, PAC augmentation is not required; without phenol recovery, PAC is needed to produce a comparable effluent. Dephenolization also enhances the stability of biooxidation, and reduces the minimum HRT required. With tertiary treatment, both schemes can meet the effluent concentrations published in the SRC-I Final Enviornmental Impact Statement, as well as the anticipated effluent limits. However, phenol recovery does provide a wider safety margin and could eliminate the need for some of the tertiary treatment steps. Based solely on the technical merits observed in this study, phenol recovery is recommended. The final selection should, however, also consider economic tradeoffs and results of other studies such as toxicology testing of the effluents. 34 references, 30 figures and 26 tables.

32502 **(DOE/OR/03054—50-App.A-Vol.2) Interim report on the genetic and animal toxicity testing of SRC-I products, intermediates, and waste materials. Appendix A. Volume 2. Microbial mutagenicity evaluations (Ames test) option IA reports.** Drozdowicz, B.Z.; Kelly, C.M. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 251p. NTIS, PC A12/MF A01; GPO Dep. Order Number DE84013325.

SRI International examined ICRC's 14 samples (SRC Middle Distillate, SRC solid (aqueous and saline suspensions and concentrate of water extract), extract and suspension of Kerr-McGee residue, etc.) for mutagenic activity in the standard Ames Salmonella/microsome in vitro mutagenicity assay using strains of Salmonella typhimurium. All assays were performed in the presence and absence of a rat-liver metabolic activation system. Testing was conducted in compliance with the provisions of the United States Food and Drug Administration Good Laboratory Practice (GLP) Regulations. The results are summarized in the base report.

32503 **(DOE/OR/03054—50-App.B-Vol.2) Interim report on the genetic and animal toxicity testing of SRC-I products, intermediates, and waste materials. Appendix B. Vol. 2.** Drozdowicz, B.Z.; Kelly, C.M. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 279p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84013327.

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SRC International examined SRC products listed (10 items) for mutagenic activity at the thymidine kinase locus in L5178Y mouse lymphoma cells in the absence and presence of a metabolic activation system. For a concise summary of the results see the abstract of the main report. (LTN)

32504 **(DOE/OR/03054—52) Corrosion of fractionation towers in coal liquefaction plants.** Bagga, P.S.; Harris, C.F.; Baumert, K.L. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013371.

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Severe corrosion has been observed in the fractionating towers at the Wilsonville, Alabama Advanced Coal Liquefaction Facility and at the Ft. Lewis, Washington Pilot Plant. At Wilsonville, the high corrosion rate of carbon and of types 304 and 316 stainless steel occurred when the facility was processing coal with 0.15 to 0.39 wt % chloride. This corrosion was most severe in the 440 to 485°F (225 to 250°C) boiling range. The analysis of scale on coupons immersed in the tower showed a high concentration of water-soluble chloride. The analysis of organic compounds in the tower liquids revealed a large amount of acid fractions like phenols and cresols, and basic fractions like aniline. During lab experiments with liquids rich in chlorides and acid and basic fractions, a high corrosion rate was observed. Absence of one or more of these fractions resulted in negligible corrosion. Based on these observations, it is concluded that when water-soluble chlorides, basic nitrogen compounds (basic fractions), and phenols (acid fractions) are simultaneously present in the coal liquids, they exhibit a synergism that results in high corrosivity. In order to reduce the corrosion to acceptable levels, it is recommended that 904L and 317 stainless steel be used as the material of construction for the fractionation tower.

It is also recommended that a chloride removal scheme be employed; the scheme would combine removal of chlorides before they reach the tower and a small side draw from the tower. 14 references, 11 figures, 8 tables.

32505 **(DOE/OR/03054—55) RO feed pretreatment and flat cell tests for SRC-I wastewater.** Watt, J.C.; Cahill, C.J.; Cowan, W.F.; Schwoyer, W.K.L. (Catalytic, Inc., Philadelphia, PA (USA); International Coal Refining Co., Allentown, PA (USA)). Mar 1984. Contract AC05-78OR03054. 172p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84014061.

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To assess the feasibility of reverse osmosis (RO) in the SRC-I Demonstration Plant, Catalytic, Inc. conducted tests on biologically treated wastewaters generated during other studies. The efficacy of the post-bio-oxidation treatment steps, including tar acid precipitation, filtration, softening, carbon adsorption, and ozonation, was first evaluated to determine if these steps met the requirements recommended by RO membrane manufacturers. The pretreated wastewaters were then used to run 400-h RO flat cell tests. As a secondary objective, the studies were conducted to generate samples for toxicology testing, since the treated wastewaters might at times be discharged into the river. 12 references, 50 figures, 20 tables.

32506 **(DOE/OR/03054—58) Full-scale cold-flow modelling of the SRC-I slurry fired heater at Creare, Inc.** Mehta, D.C. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013792.

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The slurry fired heater is a crucial piece of equipment in the SRC-I Demonstration Plant. The design of the fired heater has not been tested in any other plant under a similar combination of operating severity and multiphase flow. The cold-flow modelling experiments were conducted to confirm the fired heater design and to develop acceptable boundaries of flow rates for proper operation of the fired heater. The primary objectives were to identify the flow regimes, estimate pressure drops and measure heat transfer coefficients at a variety of fired heater operating conditions. The results definitively confirm the presence of a slug flow regime in the fired heater at the full range of operating conditions. Slug flow is desirable to avoid coking and excessive temperature gradients in the heater pipes and because of its relatively low pressure drop. The gas holdup predictions by the Hughmark correlation were in good agreement with the experimental results. A simplified correlation was developed to calculate gas holdup in the SRC-I fired heater pipes. The pressure drop results also confirmed that the experimental values were less than the design values. The Hughmark correlation was able to predict the pressure drop for the viscous fluids within +-20% of the measured value. The heat transfer coefficients calculated from the experiments were almost twice as high as those used in the design of the fired heater. The tests were successful based on the data developed, and the results confirm the fired heater design and indicate flexibilities in its operation.

32507 **(DOE/OR/03054—62) Liquid product characterization and compatibility studies. Final technical report.** Skinner, R.W.; Cusick, R.C.; Stawasz, W.W.; Tiedge, W.F. (International Coal Refining Co., Allentown, PA (USA); Air Products and Chemicals, Inc., Allentown, PA (USA)). Feb 1984. Contract AC05-78OR03054. 134p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013976.

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This program measured the physical and chemical properties of the proposed product liquids from the SRC-I Demonstration Plant, and of their constituent streams from the first stage, hydrocracker, and coker. The liquids' storage stability and the compatibility of demonstration plant product liquids with No. 2 and No. 6 fuel oils were also determined. The analytical results were compared with ASTM fuel specifications and interpreted in terms of preferred end-use applications and upgrading requirements for the SRC-I product liquids. The program also evaluated a range of analytical procedures to determine their suitability for characterizing coal-derived fuels. SRC-I middle distillate has reasonably good storage stability but is not compatible with No. 2 fuel oil. It should be able to displace No. 2 oil in certain dedicated-use industrial boilers, even though it does not meet all the ASTM specifications. SRC-I heavy distillate has fair/poor storage stability, but is fairly compatible with No. 6 fuel oil. No stability enhancing additives have been tested. Although it cannot meet all the ASTM No. 6 oil specifications, it should be acceptable for dedicated-use industrial boilers. Combined SRC-I heavy and middle distillates are a good cutter stock for reducing the viscosity of petroleum vacuum residuum to meet the No. 6 fuel oil specifications. 12 references, 40 tables.

32508 **(DOE/OR/03054—91) Comparative toxicity of SRC-I wastewater to aquatic organisms. Final technical report.** Bailey, H.C. (SRI International, Menlo Park, CA (USA)). Jan 1984. Contract AC05-78OR03054. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013977.

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SRI International performed a series of acute and chronic toxicity studies on SRC-I wastewaters using fish, zooplankton, and algae as test organisms. The tests were designed to determine the toxicity of SRC-I wastewaters to quatic organisms and based on differences in toxicity of the various water samples, to evaluate the efficacy of various wastewater treatment methods. Survival data from acute and chronic daphnid studies indicate that phenol recovery markedly reduced wastewater toxicity. In treatment processes that did not include phenol recovery, powdered activated carbon reduced toxicity more effectively than granulated activated carbon. All treated water supported algal growth in excess of that in controls, particularly those waters subjected to phenol recovery. The toxicity of each SRC-I wastewater sample was compared with that of a corresponding synthetic salt solution to determine whether the salt load was the toxic element. The wastewaters typically exhibited higher toxicity than their associated salt solutions. The effect was greatest in the daphnid chronic studies. The aquatic ecotoxicity tests were performed as part of ICRC's post-Base-line environmental R & D program. One objective of the program was to evaluate the impact of phenol recovery on effluent quality. Another objective was to assess the potential impact of wastewater discharge on aquatic organisms. The results of this study have been integrated with results from the rest of the R & D program, and are documented in ICRC's Integration Report for SRC-I Post-Baseline Environmental R & D. 7 references, 10 figures and 22 tables.

32509 **(DOE/OR/03054—96-Vol.1) Subcontracted R and D final report: SRC-I phase equilibrium and enthalpy data for coal liquefaction and solvent recovery areas. Volume 1.** Mehta, D.C.; Chu, I.C. (International Coal Refining Co., Allentown, PA (USA)). Mar 1984. Contract AC05-78OR03054. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84014117.

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International Coal Refining Company instituted a 2-year program to develop new data on SRC-I coal liquids and related model compounds. Specifically, the overall program obtectives were to develop vapor/liquid equilibrium (VLE) and enthalpy data to modify the existing petroleum-based correlations and verify the designs of several pieces of process equipment in the SRC-I Demonstration Plant. The analytical characterization of coal liquid samples was performed by Air Products and Chemicals, Inc. The VLE program was subcontracted to Chromaspec Corporation and the enthalpy data were developed by Colorado School of Mines. 6 references, 19 figures, 30 tables.

32510 **(DOE/OR/03054—96-Vol.2) Subcontracted R and D final report: SRC-I phase equilibrium and enthalpy data for coal liquefaction and solvent recovery areas. Volume 2.** Mehta, D.C.; Chu, I.C. (International Coal Refining Co., Allentown, PA (USA)). Mar 1984. Contract AC05-78OR03054. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84014118.

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Vapor-liquid equilibrium measurements were taken for coal liquids in contact with various pre-mixed gases consisting mostly of H_2, N_2, CO, H_2S, and light hydrocarbons, as well as coal liquids in contact with H_2 and ethane mixtures to simulate SRC-I Demonstration Plant. Additionally, vapor-liquid equilibrium measurements were performed with hydrogen in contact with various pure components for correlation purposes. Temperatures ranged from 115°F to 840°F and pressures ranged from 40 psia to 2000 psia. The vapor-liquid equilibrium data obtained in this task will permit checks of the process design conditions in the hydrogen recovery section of the SRC-I Demonstration Plant and will be used in simulation studies at different processing conditions. The phase equilibrium program consists of process check points, correlation check points, and hydrogen and liquid-component K-values. The hydrogen K-values are to be used in determinations of losses and feed compositions to the Demonstration Plant's Hydrogen Purification Unit, while the methane, ethane, and propane K-values will be used in calculations involving auto-refrigeration in the same units. Water K-values and the distribution of water between the organic and aqueous phases will be used to determine water flow rates and water loading in the process solvent column. The K-values of the heavy components are to be used to determine equipment sizes and loading in the hydrogen recovery section. 50 figures, 51 tables.

32511 **(DOE/OR/03054—96-Vol.3) Subcontracted R & D final report: SRC-I phase equilibrium and enthalpy data for coal liquefaction and solvent recovery areas. Vol. 3.** Mehta, D.C.; Chu, I.C.; Kidnay, A.J.; Yesavage, V.F. (International Coal Refining Co., Allentown, PA (USA); Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). Mar 1984. Contract AC05-78OR03054. 259p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84014119.

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The Enthalpy Program was a 20-month project initiated on January 18, 1982 by the International Coal Refining Company (ICRC) and under the technical direction of Professor Arthur J. Kidnay and Professor V.F. Yesavage at the Colorado School of Mines (CSM), Golden, Colorado. The objective of the program was to gather enthalpy data on representative pure model compounds, mixtures of model compounds, and selected coal-derived liquid samples furnished by ICRC. A copy of the technical agreement between ICRC and CSM is included in this report as Appendix A. This final report contains a complete description of the calorimeter and the experimental procedures used, separate data sections for each experimental task, and a copy of the technical agreement between ICRC and CSM. Data are presented for 11 coal liquid fractions. Each section of this report is organized to stand alone; thus, there are no general lists of references, tables of notation, or overall data tables.

32512 **(DOE/OR/03054—100) Extension of the evaluation of reverse osmosis for SRC-I wastewater. Final technical report.** (Catalytic, Inc., Philadelphia, PA (USA)). Jun 1984. Contract AC05-78OR03054. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013634.

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Reverse osmosis (R.O.) is an integral part of the zero discharge option for the proposed SRC-I Demonstration Plant. The original laboratory treatability testing program for reverse osmosis failed to demonstrate the technical feasibility of this process, due to problems with membrane fouling and deterioration. In that study (1), a high pressure (800 psi) polyether urea membrane for sea water and a low pressure (400 psi) cellulose diacetate membrane for brackish water failed to maintain reasonable TDS rejection rates during flat cell tests. The problem was particularly severe for the high pressure membrane. At the end of the original study, testing was continued on two additional low pressure membranes. One of these was a cellulose diacetate triacetate blend. The other was a new polyaramid membrane, which had only recently become commercially available. This report documents the results of all of the reverse osmosis laboratory tests. The wastewaters used in this study were effluents from bench scale, two-stage bioreactors, followed by tertiary treatment consisting of coagulation, softening, filtration, and granular activated carbon. The investigative program consisted of both immersion and flat cell tests. The results show tht the SRC-I wastewaters are difficult to treat by reverse osmosis with polyether urea or cellulose acetate membranes, and membrane failure was common. However, the new polyaramid membrane was found to be satisfactory when tested with a dephenolated feed stream. After over 1500 hours of continuous flat cell testing, it exhibited a TDS rejection rate of 95%. Based on these preliminary results, reverse osmosis does appear to be a technically feasible approach to achieve zero discharge, assuming the feed stream is dephenolated.

32513 **(DOE/OR/03054—101) Evaluation of thickening and dewatering characteristics of SRC-I wastewater treatment sludges. Final technical report.** (Catalytic, Inc., Philadelphia, PA (USA)). May 1984. Contract AC05-78OR03054. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013560.

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The SRC-I Demonstration Plant in Newman, Kentucky, will generate several different sludges as a result of providing extensive wastewater treatment. Because construction of this plant has been postponed indefinitely, there has been an opportunity to generate additional data pertinent to waste treatment. Accordingly, this report presents the results of a study on the thickening and dewatering characteristics of several of the wastewater treatment sludges. The study included: evaluation of chemical conditioning agents; aerobic digestion of biological sludges; gravity thickening; and the relative effectiveness of dewatering by centrifuge, vacuum filter, belt filter, and pressure filter. Sludges were tested individually and in combination. The results indicated that the biological sludge could be best dewatered by pressure filtration. The chemical sludges should be combined prior to dewatering, which should be provided by a belt filter. The tar acid sludge will be kept separate, due to its low pH, and ultimate disposal will be by incineration. The tar acid sludge was more concentrated than had been expected. As a result, thickening, rather than centrifuging, is the recommended treatment for this sludge. All sludges were tested for leachate toxicity by the extraction procedure method. The results were negative, indicating the sludges are non-hazardous in heavy metal concentrations, according to RCRA classification. The test results have identified design changes for the proposed wastewater treatment facilities.

32514 **(DOE/OR/03054—107) Biokinetic study for SRC-I wastewater.** (Catalytic, Inc., Philadelphia, PA (USA)). Jun 1984. Contract AC05-78OR03054. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013780.

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Biooxidation is an important part of the overall wastewater treatment system for the proposed SRC-I Demonstration Plant in Newman, Kentucky. After the completion of a Baseline Design for the plant in April 1982, various refinements were evaluated. One of these was the inclusion of a process for phenol recovery from four sour-water streams. As part of this evaluation, an extensive laboratory treatability study was conducted on wastewaters both with and without this phenol recovery step. The purpose of the study was to compare the results of different treatment schemes on different wastewaters and did not include the development of the kinetic coefficients that govern the biooxidation process. Additional treatability testing documented herein, has been performed to establish the kinetic coefficients for biooxidation of the SRC-I wastewaters. This will provide a rational basis for any subsequent changes in design. The wastewater feed used in this study was process recycle water from the Fort Lewis, Washington, pilot plant. Prior to biooxidation, it was pretreated by solvent extraction for removal of phenolics and by steam stripping for removal of ammonia and hy-

drogen sulfide. Two, 2-stage bench scale bioreactors were operated for approximately eight months, during which time they were stabilized at various steady-state conditions. Kinetic coefficients were evaluated according to the Lawrence and McCarty model, based on BOD, COD, and TOC. Nitrification, oxygen utilization, and solids settling velocities were also studied. The results showed that BOD is a poor basis for the model mainly because almost all BOD_5 was removed at all steady-state conditions. Also, the model was more accurate for steady-state conditions of lower solids retention times. The bulk of both organic and ammonia reductions occurred in the first stage reactors.

32515 **(DOE/PC/30217—T5) Pyrolysis of coal-derived fuels using the laser-powered homogeneous pyrolysis technique.** de Boer, P.C.T. (Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering). Mar 1984. Contract FG22-80PC30217. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84012798.

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Detailed results are presented on the application of the Laser-Powered Homogeneous Pyrolysis Technique to hydrocarbon species. Measurements of the mean reaction temperature of the sample cell in the range 580 to 890°K were made with a chemical thermometer, using various unimolecular reactions with known rate constants. The results agree quite well with the temperature at mid-height on the centerline of the cell, as measured with a thermocouple. A set of equations was developed describing the motion and the temperature field of the strongly heated gas in the sample cell. These equations follow from the exact equations of fluid dynamics by using formal perturbation theory, with the nondimensionalized depth of the fluid as the only small parameter. Numerical solution of these equations by computer is no more complex than solution of the Boussinesq approximate equations used by previous investigators. Detailed computer solutions are obtained for a number of cases, and the results are compared with results based on the Boussinesq equations. The two sets of results differ significantly, especially for cases where much of the laser power is absorbed near the bottom of the sample cell. The agreement between computed and measured values is very good at temperatures up to about 800°K, and reasonably good at temperatures in the range 800 to 1200°K. Detailed results are reported on the homogeneous pyrolysis of toluene in the temperature range 940 to 1190°K. The decomposition rate measured agrees with that reported by previous investigators. Major product species observed are benzene and methane; additional products are ethylene, acetylene and ethane. It is concluded that the Laser-Powered Homogeneous Pyrolysis Technique can provide useful information on pyrolysis products of hydrocarbons at low to moderate temperatures.

32516 **(DOE/PC/50001—15) Advanced coal liquefaction research. Quarterly technical progress report, January 1-March 31, 1983.** (Gulf Research and Development Co., Shawnee Mission, KS (USA)). Dec 1983. Contract AC22-82PC50001. 206p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84004074.

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This report describes progress on the Advanced Coal Liquefaction project by the Gulf Research and Development Company's Merriam Laboratory during the months of January through March 1983. The liquefaction behavior of Illinois No. 6 coal beneficiated in various ways was studied in both single-stage recycle (SRC II) and short contact time (SCT) modes of operation. The distillate yield increased as the iron level in the feed slurry increased in both modes of operation. In the SCT mode, the conversion increased at greater depths of cleaning. In the SRC II mode, the distillate yield and conversion were much higher with deep cleaning and add-back of pyrite than with conventional cleaning. Pyrite addition resulted in a significant increase in short contact time conversion of subbituminous Belle Ayr coal in both high and low quality solvents. Solvent quality itself, however, had little effect on conversion. With Loveridge coal, the hydrocarbon gas yield and conversion decreased as the residence time was reduced in the range of 3 to 8 minutes. The bottoms product was filterable only at residence times of 6 minutes or greater. Addition of a small amount of nickel to a molybdenum emulsion catalyst improved yields slightly with Belle Ayr coal in the SRC II mode. Higher levels of nickel resulted in the same oil yield as with none at all.

32517 **(DOE/PC/50041—37) Wilsonville Advanced Coal Liquefaction Research and Development Facility technical progress report. Run 244 with Illinois 6 coal.** (Catalytic, Inc., Wilsonville, AL (USA)). May 1984. Contract AC22-82PC50041. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013174.

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This report presents the operating results for Run 244 at the Advanced Coal Liquefaction R and D Facility in Wilsonville, Alabama. This run was made in an all-distillate Integrated Two-Stage Liquefaction (ITSL) mode using Illinois 6 coal from the Burning Star mine. The primary objective was to demonstrate the effects of temperature programming an aged catalyst batch on the ITSL product slate, especially on the net C_1-C_6 gas production and hydrogen consumption. Other objectives were to demonstrate the effect of fresh catalyst addition and to age the catalyst batch for an extended run with catalyst addition and withdrawal. Run 244 began on 4 July 1983 and continued through 27 September 1983. During this period, 182.9 tons of coal was fed in 1872 hours of operation. Seven special product workup material balances and two hydrotreater balances were defined, and the results are presented herein. From 27 to 30 September, 7.4 tons of Wyodak (Clovis Point mine) subbituminous coal was fed in 79.2 hr. This special test was performed to determine TL unit and CSD unit operability and to obtain design information for coal slurry drying. Preliminary results of a run with subbituminous coal are presented herein. 4 references, 29 figures, 20 tables.

32518 **(DOE/PC/50051—T4) Development of a reference data system for the liquefaction technology data base. Final technical report, 22 September 1982-3 August 1983.** Gallier, P.W.; Boston, J.F.; Wu, P.C.; Yoon, E.S. (Aspen Technology, Inc., Cambridge, MA (USA)). 31 Jan 1983. Contract AC22-82PC50051. 165p. NTIS, PC A08/MF A01. Order Number DE84004620.

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The overall objective of this project is to create a prototype reference data system, built around the ASPEN process simulation system, which will include those thermophysical properties of coal liquids necessary to calculate vapor-liquid equilibrium (VLE) and perform heat and material balance (HMB) calculations. An important emphasis of the project is applicability to coal liquids from the SRC-II process. The properties that are most often needed for VLE and HMB calculations are K-values, enthalpies and densities of both vapor and liquid mixtures. Vapor and liquid enthalpies are generally expressed in terms of departures from the ideal gas enthalpy at the same temperature. This means that a model is required for the calculation of the ideal gas heat capacities of all components present, and that other models are needed to estimate the departures as functions of temperature, pressure and composition. K-values are generally expressed in terms of liquid and vapor fugacities. Models are therefore also required to estimate these quantities as functions of temperature, pressure and composition. A variety of models and correlations are available for the calculation of the required thermophysical properties in the ASPEN process simulation system. All models and correlations of the types mentioned depend on parameters which are characteristic of the components present in a mixture. For example, the RKS equation of state uses three pure component parameters - critical temperature, critical pressure and acentric factor - and one binary interaction parameter for each pair of components.

32519 **(DOE/PC/50786—7) Arylations of coal model systems.** Smith, B.F.; Venier, C.G.; Squires, T.G. (Iowa State Univ. of Science and Technology, Ames (USA). Energy and Mineral Resources Research Inst.). 1984. Contract FG22-82PC50786. 7p. (CONF-840805—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008848.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

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Currently, coal is converted to clean liquids or low melting solids by processes which utilize high temperature, high pressure, or both. These processes occur by thermal bond cleavages and in-

volve the intermediacy of free radicals. In a search for chemistry which could liquefy coal under milder conditions, the authors have focussed on thermally less demanding ionic reactions. Of the functional groups which commonly occur in coals, ethers are the easiest to cleave under acid conditions. Depending on the density of these linkages and their importance as crosslinks in the macromolecular structure of coals, solubilization might be greatly enhanced solely by cleaving and capping either bonds. Benzylic ethers are particularly reactive and have been implicated in the initiation of coal pyrolysis and hydropyrolysis. Arylation, the use of acids to cleave bonds in coals in the presence of aromatic rings to trap the consequent incipient carbonium ions, has a long history. This paper discusses the use of benzyl phenyl ether and l-naphthylmethyl phenyl ether and polymers related to them as models to develop and evaluate the chemistry involved in the arylations. 9 references, 1 figure, 4 tables.

32520 **(DOE/PC/50793—T7) Combined processing of coal and heavy resids. Progress report, January 16, 1984-April 15, 1984.** Curtis, C.W.; Guin, J.A.; Tarrer, A.R. (Auburn Univ., AL (USA)). 1984. Contract FG22-82PC50793. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84012796.

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Petroleum crudes and residua and coal have been coprocessed at typical liquefaction conditions in atmospheres of nitrogen and hydrogen and in the presence of hydrogen and a catalyst. At 400°C coal conversion in a nitrogen atmosphere was low and at the same level as the thermal coal reaction with no solvent, indicating that no transfer of hydrogen from the petroleum solvents to the coal occurred. Coal conversion increased in the presence of hydrogen; further increases in coal conversion were observed in the presence of catelyst at 400 to 425°C. The dominant factor of the increased conversion in the majority of the heavy petroleum materials was the presence of the catalyst with the 25° temperature rise being a secondary effect. Oil production from combined processing showed negative or level yields in the N_2 atmosphere, level or slightly positive yields in the H_2 atmosphere and for most petroleum solvents significant increases when a catalyst and hydrogen were both present. As in the case of coal conversion the catalyst appears to be the dominant factor in the increase with temperature having a secondary effect. Individual differences among the petroleum solvents are observed in the product distributions obtained from combined processing. Coal conversion in the H_2 atmosphere appears to be correlated with viscosity, molecular weight and Conradson Carbon number of the petroleum crude. These particular solvent characteristics do not seem as important in coal conversion when a catalyst is present. The parametric evaluation has determined optimal conditions for combined processing. Coal conversion and oil production from combined catalytic (powdered) processing compare favorably with that from tetralin with a powdered catalyst. 11 references, 6 figures, 30 tables.

32521 **(DOE/PC/60046—2) Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Second quarterly report, December 20, 1983-March 31, 1984.** Chen, W.Y. (Gulf South Research Inst., New Orleans, LA (USA)). 5 Jun 1984. Contract AC22-83PC60046. 32p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012288.

Research was extended to study the effects of liquefaction variables on yield structures. Experimental conditions were carefully chosen to examine the effects of temperature, solvent density and reaction time on Illinois No. 6 coal and a Wyodak subbituminous coal. Elemental analysis of a solid sample derived from Illinois No. 6 coal was also performed. While temperature is the most important variable to the amount of ammonia extract, the data also demonstrate the potential significance of using polar nucleophilic compounds in supercritical fluid extraction of coal. First, conversion to ammonia extract increases with increasing NH_3 density. The effect of solvent density on Illinois No. 6 coal is more notable than Wyodak coal. This indicates that the process could involve other limiting factors such as mass transfer and solubility. Second, in comparison with published liquefaction work, ammonia provides higher conversions than other chemically inert, non-polar, non-nucleophilic, supercritical fluids. This intimates the chemical role of nitrogen-containing compounds. Ammonia almost completely removes the sulfur in Illinois No. 6 coal. However, elemental analysis also shows 3.4 nitrogen adduction per 100 gram of coal. 27 references, 7 figures, 4 tables.

32522 **(DOE/PC/60783—2) Study of the kinetics of hydrogenation using aged catalysts. Quarterly technical progress report, 1 October 1983-31 December 1983.** Schweighardt, F.K. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Feb 1984. Contract FG22-83PC60783. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006588.

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Design and construction of the special high pressure autoclave reactor with catalyst basket, unique sample feed and automated sample collection system are in progress by outside contractors. Performance testing of the total reactor system will be delayed 70 days because of construction delays by Autoclave Engineers and relocation of the new high pressure safety cell required special modifications to allow for a safe operation. Chemical reactants (model polynuclear aromatic hydrocarbons) have been selected, ordered and received. Extensive chemical characterization of the reactants is underway to define purity levels. Samples will undergo recrystallization or sublimation to achieve 99.5% single isomer purity. Catalyst material has been received from J. Gough, Manager Wilsonville Coal Liquefaction Facility. Other catalyst material has been defined and requested from H. Schlinder, CE Lummus Company and Wilsonville. A number of reaction solvents for the kinetic study are under evaluation. It is anticipated that at least one perfluorinated solvent (3M Company) will be evaluated in detail under Task 2 (4th quarter FY 1984). We wish to compare and contrast mass transfer effects of hydrogenation in perfluorinated and hydrocarbon (C-16) solvents wih identical catalyst samples.

32523 **(DOE/PC/60793—2) Studies of the stabilization of coal liquids. Quarterly report of progress II.** Davies, G. (Northeastern Univ., Boston, MA (USA). Dept. of Chemistry). 1984. Contract FG22-83PC60793. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008016.

The nature of inhibition of gum formation and viscosity increase brought about by relatively low levels of the cheap, available additive cyclohexanol has been investigated. The viscosity of fuel C containing progressively larger amounts of cyclohexanol decreases to a very broad minimum at ca. 70% w/w cyclohexanol. Comparison of the infra-red spectra of B, C, GFB2, GFC2 and their respective gums (precipitated with pentane) shows that - OH and -C = N functions are concentrated in the gums, as are the metals (determined by plasma emission spectroscopy). The V/sub OH/ and V/sub C=N/ bands of the fuels are shifted by +- (5 to 15) cm^{-1} on addition of 10% w/w cyclohexanol, again pointing to a physical additive-fuel interaction. Molecular weight measurements for gums (from B and C), GFB2, GFC2, B and C have been measured cryoscopically in nitrobenzene (K/sub f/ 7.0) and cyclohexanol (K/sub f/ 30.7). Gum averages 390 to 420 daltons, while the liquid fuel averages are in the range 300 to 345 daltons in nitrobenzene. Gums are thus precipitated from fuels by hydrocarbons because they are more polar, not because they are of high molecular weight. The measured molecular weights of B and C are lower in cyclohexanol (average 190 to 220 daltons) than in nitrobenzene. The evidence presented thus shows that cyclohexanol acts as a viscosity stabilizer and gum preventative by breaking hydrogen-bond interactions between fuel components, which would otherwise assist fuel oxidation to produce larger molecules and gum, as well by dissolving gum already present in the fuel. Manometric measurements of dioxygen uptake at 25°C on such fuel-cyclohexanol mixtures show that this additive retards the rate of fuel oxidation by dioxygen but measurable rates are still observed.

32524 **(DOE/PC/60808—2) Evaluation of intermolecular attractive forces in coal derived liquids. Quarterly report, February 1984-April 1984.** Jones, M.B. (North Dakota Univ., Grand Forks (USA)). Jun 1984. Contract FG22-83PC60808. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013317.

Quantitative solubility measurements of nine model compounds and seven coal derived preasphaltene samples (four native, three derivatized by acetylation) have been carried out in twelve solvents. Plots of model compound solubility versus solubility parameter exhibited, in general, maxima of ca. 9 to 9.5 H, in agreement with literature results for coal derived asphaltenes. Similar plots for the native preasphaltene samples revealed maxima of ca. 10.5 to 11 H, in accord with reported studies. Little correlation between solubility of model compounds and either net hydrogen bonding indices or donor number minus acceptor number values of solvents was observed. General trends of increasing dissolvability of preasphaltenes with increasing net hydrogen bonding indices or increasing donor number minus acceptor number values of solvents were noted. 13 figures, 5 tables.

32525 **(DOE/PC/61256—T2) Coal conversion processes. Quarterly report, December 13, 1983-March 12, 1984.** Cobb, J.T. Jr.; Biloen, P.; Holder, G.D.; Klinzing, G.E.; Tierney, J.W. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). May 1984. Contract FG22-83PC61256. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013632.

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Experimental work is continuing on four separate projects related to coal conversion processes. The direct digital control of exothermic multiphase reactions is being studied in an experimental adiabatic flow reactor. The existence of two stable steady states for the Fischer-Tropsch reaction network at the same temperature and feed condition has been verified and quantified. Various absorbents for SO_2 and NO/sub X/ are being studied. The absorption of NO_2 by methanol and N-cyclohexyl-2-pyrrolidone has been extensively examined. Preliminary data have been obtained with triethylene-tetraamine. Hindered amines will be studied next. Procedures for the preparation of liquid membranes have been tested and the incorporation of hindered amines in them will now be examined. Isotopic switching is being used to study the way in which promoters affect supported metal catalysts. With improved resolution from the mass spectrometer, early quantitative results give indications of three different surface species and of non-statistical ingrowth of ^{13}C into the product molecules. A program for the study of the extraction of coal and oil shale using supercritical fluids is being carried out. The effect of the presence of piperidine on the amount of toluene solubles produced by supercritical extraction of coal with toluene/piperidine mixture has been determined. A new kinetic model for the extraction/liquefaction of coal by supercritical toluene and THF has been developed and proven satisfactory. Bruceton coal and Hi Na lignite have been extracted with supercritical water. 3 references, 7 figures, 6 tables.

32526 **(DOE/PETC/TR—84/8) Characterization of vacuum bottoms from the P-99 coal liquefaction unit.** Lett, R.G.; Schmidt, C.E.; Finseth, D.H.; Hough, M.R.; Link, T.A.; Sprecher, R.F.; Retcofsky, H.L. (USDOE Pittsburgh Energy Technology Center, PA). 1984. 60p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014176.

A composite sample of vacuum bottoms has been analyzed by structural sensitive techniques applicable to high molecular weight, highly functional coal-derived materials. The utilization and limitations of x-ray diffraction, infrared, high resolution and ^{13}C-CP/MAS nuclear magnetic resonance, high resolution and field ionization mass spectrometry, and electron spin resonance are discussed. Particular emphasis is given to the characterization of methylene chloride soluble fractions, isolated by a combination of mild extraction and functionality-specific procedures, in terms of heteroatom functionality, molecular weight and carbon number distributions, and mean structural parameters. This nondistillate but soluble material is primarily a complex mixture of high molecular weight polynuclear aromatic and heterocyclic components with short alkyl substituents. The vacuum bottoms are low in phenolic OH functionality compared to typical SRC-II distillates. 9 references, 25 figures, 14 tables.

32527 **(DOE/RL/01830—T21) Development of an advanced water-gas shift conversion system. Quarterly progress report, February 1-April 30, 1984.** Sealock, L.J. Jr.; Elliott, D.C. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014085.

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A new project was initiated at Pacific Northwest Laboratory (PNL) in February 1984. The project sponsored by the US DOE Morgantown Energy Technology Center (METC) has as its objective to demonstrate the use of an aqueous catalyst system for conducting the water-gas shift reaction. Design and ordering of equipment for the experimental system was the major activity during the quarter. The continuous experimental system is built around an 11 autoclave and will be operated to prove the engineering concept and to establish processing conditions required to evaluate the potential of the process. The majority of equipment items have been received or are in transit. An Operational Readiness Review (ORR) is progressing which will allow operation of the Chemical Process Development Laboratory (CPDL). The CPDL is a 25 x 25 ft square building which will house the experimental system. An ORR board has been appointed by the PNL Director of Research and several meetings have been held. An ORR plan has been drafted and is being reviewed, as is the Safety Evaluation Document for the building. Refurbishing of the CPDL is nearly complete including fabrication and installation of the plate steel barrier that houses the experimental system. Assembly and installation of the continuous, water-gas shift reactor was initiated the last week of April and is expected to be completed in May. Standard Operating Procedures for the experimental system have been written and been sent to the PNL Industrial Health and Safety Department for approval. 7 references, 4 figures.

32528 **(EPRI-AP—3439) Roles and origins of active solvents for coal liquefaction. Final report.** Morrey, J.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 56p. NTIS, PC A04/MF A01; 1 - EPRI; GPO Dep. Order Number DE84012732.

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In today's liquefaction processes some coals give off gas and undergo retrogressive reactions before they have dissolved completely. The use of selective solvent recycle, however, may make it possible to dissolve coal completely and at milder conditions, thus eliminating the waste production of gas and unreactive by-products. In this project, RP2147-1, researchers performed a detailed chemical analysis of eight sample coal liquefaction solvents, both distillate and resid, using several techniques. The samples, whose liquefaction behavior was known, had been subjected to various degrees of hydrotreatment and distillation before analysis. The analysis sought a relationship between solvent composition, liquefaction conversion, and yield. Researchers also examined the impact of process conditions on the effectiveness of the solvents. The objective was to improve techniques for dissolving coal by identifying the roles and origins of active solvents and solvent components. The analytic techniques employed in this project gave a good representation of the easily identified solvent components. The composition of the extremely heavy material that is the most effective solvent recycle, however, remains unknown. Results indicated the following: The least effective residual solvent contained substantial amounts of light solvent (-800°F, mono- and dimethylnaphthalenes); the most effective residual recycle had been mildly hydrotreated (pyrene was its most abundant polyaromatic hydrocarbon); the typical distillate solvent (550 to 850°F) contained large quantities of aliphatics and resembled an SRC-II fuel-oil blend after severe hydrotreatment; and the distillate solvent also had a significant hydroxyl content. 21 figures, 7 tables.

32529 **(EPRI-AP—3498) Compaction and granulation of coal liquefaction residue. Final report.** Brugan, J.M.; Kohlmann, R.F.; Munro, D.R. (Allis-Chalmers Energy and Minerals Systems Co., Oak Creek, WI (USA). Process Research and Test Center). May 1984. 33p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920408.

Coal liquefaction residue was compacted into dense ribbon flakes and subsequently granulated into a particle size distribution

suitable for use in a high solids water slurry in a gasification process. The product granules apparent density was 85 to 90 percent of the true density of the residue and they displayed high resistance to dissolution in an aged, agitated slurry. The residue or ash concentrate, as derived from the Kerr-McGee Critical Solvent Deashing Process, is a fine particulate material that hinders stability and limits solids loading in slurry process applications, thereby affecting the overall gasification efficiencies and economics. Seventy-five tons of granules were produced in two successive 15 to 18 ton per day pilot plant operations. Descriptions of the processes and equipment, material properties, and material balances for typical operations are included.

32530 **(IEA/CREAS—84/08) Cost of liquid fuels from coal. Part 3. Methanol and methanol-derived gasoline.** (IEA Coal Research, London (UK). Economic Assessment Service). Mar 1983. 119p. (EAS/E—3/81/3). NTIS, PC $60.00.

This part of the study on the cost of liquid fuels from coal deals with the production of turbine-grade methanol, and of high-octane gasoline from methanol. In methanol production, coal is gasified, purified, adjusted in chemical composition and the resulting synthesis gas converted over a suitable catalyst. The crude methanol thus formed can be distilled to turbine-grade methanol or converted to gasoline using the Mobile MTG process. Production of these fuels using both dry-ash Lurgi and Texaco gasifiers is evaluated. The former gasifier involves either reforming of the methane produced to give additional synthesis gas or co-production as SNG. Coals considered are Illinois No. 6 and Wandoan (from Queensland, Australia), representing high-sulphur bituminous coal and low-sulphur sub-bituminous coal, respectively.

32531 **(LA-UR—84-1990) Optical detection of alkali compounds.** Oldenborg, R.C.; Baughcum, S.L. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014031.

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The objective of this program is to develop a laser-based optical diagnostic technique, which should be applicable to the direct monitoring of trace levels of alkali compounds within the stream of a coal gasifier. The diagnostic is based on the observation that atomic emission is detected from alkali metals upon ultraviolet photodissociation of the parent compound. From the intensity of the atomic emission, the known absorption cross section of the parent compound, and the laser fluence, the concentration of the alkali compounds can be determined over an extreme range of conditions and their chemistry can be elucidated. KCl vapor was irradiated with an ArF laser that was Raman-shifted in both H_2 and D_2. The 766.5-nm atomic potassium emission (4^2P) was observed for all excitation wavelengths between 193 and 255 nm. The relative production efficiency drops dramatically for energies below the calculated threshold wavelength of 207 nm. An absolute detection sensitivity for KCl was determined at 0.2 ppB, which is better than required for anticipated fossil fuel monitoring applications. 5 figures.

32532 **(LBL—17671) Chemistry and morphology of coal liquefaction. Quarterly report, January 1, 1984-March 31, 1984.** Heinemann, H. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013883.

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In task 1, selective synthesis of gasoline-range components from synthesis gas, rate expressions were developed for four different iron catalysts (promoted and unpromoted). Data for all four catalysts can be correlated by a semi-empirical expression. In task 2 catalyzed low temperature reactions of carbon and water, the catalytic activity for the production of hydrocarbons from graphite and water over KOH plus a co-catalyst was investigated for several first row transition metals. NiO showed the greatest activity. Several samples of ^{13}CO, $^{13}CO_2$ and H_2O adsorbed on graphite and on catalyst-graphite systems after reaction with steam were prepared for NMR investigation. In task 3 chemistry of coal solubilization and liquefaction, rate studies of quinoline reduction to tetrahydroquinoline in the presence of the homogeneous catalysts $(phi_3P)_3RhCl$ have provided definitive evidence that benzothiophene, indole, pyrrole, carbazole, thiophene, p-cresol and dibenzothiophene enhance the initial rate of hydrogenation of quinoline by a factor greater than 1.5. P-cresol was found to enhance the initial rate of hydrogenation of quinoline (1.6 to 2 fold) in a model coal liquid with polymer-supported (2% cross-linked) $(phi_3P)_3$ RhCl. 2 references, 6 figures.

32533 **(MLM—3158(OP)) Mass flow measurement at Wilsonville Advanced Coal Liquefaction Pilot Plant using micro motion mass flow meters.** Agarwal, A.K.; Turgeon, M. (Monsanto Research Corp., Dayton, OH (USA); Catalytic, Inc., Wilsonville, AL (USA)). 1984. Contract AC04-76DP00053. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013280.

Coal liquefaction pilot plants require consistently accurate measurement of coal-liquid slurry flows for both control purposes and process development information. The Micro Motion mass flow meters have been successfully utilized in this harsh environment. A low-temperature (400°F) and a high-temperature (900°F) Micro Motion mass flow meter were installed at the Wilsonville Advanced Coal Liquefaction Pilot Plant. The low-temperature mass flow meter has been operating sucessfully in the preheater feed line for the past two years. The high-temperature mass flow meter has operated successfully in the deashing solvent line and the Kerr McGee unit coal slurry feed line. Based upon the information that has been acquired concerning the operation of these mass flow meters, it appears that the Micro Motion mass flow meter can be used for the measurement of mass flows in coal liquefaction facilities. 5 figures, 2 tables.

32534 **(NE/BF—82-17) Oil from peat and biomass. Final report from the fifth stage.** Bjoernholm, P. et al. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Sep 1982. 134p. (In Swedish and English). NTIS (US Sales Only), MF A01. Order Number DE84751014.

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The aim of the project has been to present conceivable process systems for direct liquefaction of peat and biomass. Batch reactor tests have been carried out and have been extended to a continous bench scale of liquefying coal, peat and biomass. Methods have been designed for analysing and characterizing the complex products from direct liquefaction. The experimental results suggest that a satisfactory dewatering effect can be obtained around 300degreeC with relatively short residence times. The mild conditions in the first step of the process make the oxygenated groups of the raw material decompose to carbon dioxide. In the second step a distillable product is obtained. The process is believed to be advantageous also for relatively dry raw materials such as wood and milled peat.

32535 **(ORNL/SGMP—84/1) Surface Gasification Materials Program. Semiannual progress report for the period ending March 31, 1984.** Bradley, R.A. (comp.). (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 138p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84013492.

The objective of the Surface Gasification Materials Program is to conduct research and development on materials for application to the specific needs of coal gasification systems. One of the goals of the program is to evaluate innovative fabrication methods which have the potential to lower costs and improve reliability and safety for gasifier vessels and components. Another goal is to conduct engineering-scale development and application of materials for coal gasification systems to ensure that the materials of construction for pilot plants and future large-scale plants can be properly selected and specified. Contents of this report include the following: (1) plant materials surveillance tests; (2) slagging gasifier refractories; (3) protective coatings and claddings; (4) ceramic fabrication/application technology; (5) advanced pressure vessel materials technology; (6) electroslag component casting; (7) production and evaluation of electroslag castings; (8) cost reduction of the electroslag casting manufacturing process; (9) quantitative microstructural characterization of steel casting; and (10) materials review and component failure analysis in support of coal gasification processes and plants.

32536 **(PNL-SA—12342) Development of an advanced water-gas shift conversion system.** Sealock, L.J. Jr.; Elliott, D.C. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 13p. (CONF-840695—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013265.

From 4. annual advanced gasification contractors' meeting; Morgantown, WV, USA (26 Jun 1984).

Pacific Northwest Laboratory (PNL) is investigating the use of an aqueous catalyst system for conducting the water-gas shift reaction under sponsorship of the US DOE Morgantown Energy Technology Center. Reseach in the project began in February 1984 and has centered on the design and fabrication of a 1.0 liter continuous bench scale reactor system. The chemistry of the system has been documented using a batch reactor system and the pressurized, aqueous system was shown to be very effective for the water-gas shift reaction because of its low temperature operation (300°C) and because the presence of excess water in the system pushes the equilibrium far to the product side. A five percent solution of Na_2CO_3 has been the catalyst of choice, however, a wide range of base catalysts including both alkali and ammonia compounds also catalyze the reaction. Continuous gas processing kinetic tests are currently being investigated. Application of the concept for processing coal gasification synthesis gas has many potential advantages over more conventional technology including the combination of gas quenching, water-gas shift tar conversion/removal and acid gas scrubbing. 7 references, 5 figures, 2 tables.

32537 **(SAND—84-0199C) Determination of the intrinsic activity and effective diffusivity of aged coal liquefaction catalysts.** Stephens, H.P.; Stohl, F.V. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840805—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010270.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

Although severe, rapid catalyst deactivation remains a major economic impediment to the production of liquid fuels from coal by direct processing, there have been few quantitative investigations of aged catalyst intrinsic activity and effective diffusivity. This study reports a method for determining these important properties under experimental conditions that accurately model actual conditions for the processing of coal-derived liquids. The power of the technique has been demonstrated by determination of the intrinsic hydrogenation activity and effective diffusivity of catalysts obtained from the Wilsonville, Alabama coal liquefaction test facility. The values of intrinsic catalyst activity and effective diffusivity reported here are based on kinetic measurements of the catalytic hydrogenation of pyrene. Pyrene was chosen as a chemical probe of these properties because it appears to play a key role as a hydrogen transfer agent in coal liquefaction. From determination of the pyrene hydrogenation rate constants for pairs of experiments, one with powdered catalyst and the other with whole extrudates, the fraction deactivated and the Thiele modulus, which relates the intrinsic rate constant to the extrudate effective diffusivity, were determined. Experiments with fresh, aged and regenerated catalysts have allowed the contribution of deactivation due to metallic contaminants to be separated from that due to carbonaceous material, and thus has allowed the mode of deactivation for each contaminant to be determined. 13 references, 4 figures, 3 tables.

32538 **(VTT-TUTK—228) Gasification of indigenous fuels and the use of gas in commercial greenhouses.** Leppaelahti, J.; Jantunen, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Dec 1983. 39p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

Possibilities of using gasification technique in the energy production of commercial gardens is discussed. The efficiency of a heating station where sod peat is first gasified to fuel gas with an updraft method and then burnt in a usual flue boiler was measured experimentally. The efficiency of gasification ranged between 84 and 92%. The product gas was burnt in a boiler with a nominal efficiency of 1.2 MW. The air coefficient of the combustion of moist tarry gas was 1.10-1.24 and the flue gas losses were 5-10%. The total efficiency measured indirectly was 80-84% in the output area studied when the area of output regulation was 1:4. The annual efficiency would be 81-82% on the basis of the test run. However, it is reduced by daily shutdowns and sudden output changes typical of commercial horticulture. The rising rate of gasifier output was measured after a 12 h daily shutdown. The output of the gasifier rose on average at the rate of 16 kW/min. The full capacity could be reached within about 75 min after starting the air blow. In practice, the shutdowns are shorter and the insulation of the gasifier better and hence the rising rate of output was considered sufficient with regard to commercial greenhouses. The economy of a gas-fired heating station was studied in output classes of 1.7 MW, 3.3 MW and 6.7 MW. The gasification heating stations were dimensioned as base load stations with 0.5 MW, 1 MW and 2MW outputs. The price of heat was respectively about FIM 160/MWh, FIM 143/MWh and FIM 124/MWh. The profitability is not reached if the costs are compared with oil heating costs of greenhouses. If the values given in the publication KTM B:18 of the Finnish Ministry of Trade and Industry are taken as the investment and the technical efficiency values of oil heating, the profitiabilty is reached in size classes of 3.3 MW and 6.7 MW.

32539 **Department of Energy's 1978 underground coal conversion program.** Burwell, E.L.; Sikri, A.P.; Zukor, S.H. *Transactions of the American Nuclear Society;* **30**: 2(Win 1978).

The US has an abundance of energy resources, yet is currently facing grave energy supply problems. This results from heavy reliance on petroleum and natural gas, domestic reserves of which are dwindling, while the most abundant fossil energy resource (coal) is underutilized. Coal is the primary nonnuclear source for expanding domestic energy supplies through the year 2000. However, conventional underground and strip mining can recover only 6% of the 4.8 trillion Mt coal resource. Underground coal gasification (UCG) is one technology that can complement conventional mining by recovering the energy in unminable coal seams in the form of combustible gases. Coal is gasified underground by drilling boreholes into the coal seam and injecting air (or oxygen and steam) into the underground reaction zone. The hot product gases are forced through the coal to the exit borehole and are carried to the surface, where they are cleaned and processed for use.

0105 By-products

REFER ALSO TO CITATION(S) 32855

0106 Properties

REFER ALSO TO CITATION(S) 32449, 32450, 32458, 32459, 32462, 32466, 32509, 32510, 32511, 32559, 32607, 32610, 32618, 32621, 33779, 33780

32540 **(CONF-840754—1) Potential of nuclear methods for development of novel on-line sensors for coal analysis.** Herzenberg, C.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013432.

From 5. annual meeting of the Fine Particle Society; Orlando, FL, USA (30 Jul 1984).

A study has been conducted to identify nonstandard and novel instrumental analysis techniques and to evaluate their potential for development to provide new types of sensors for on-line analysis of coal and for other fossil energy applications. New methods from basic research, and methods used or considered for use in other industries such as mineral and basic metal industries, in petroleum and other well logging, and in biomedical applications have been examined. Particular fossil energy applications have been identified, and equipment requirements and spoolpiece and window requirements for process stream measurements, development status, obstacles to be overcome in development, and other relevant topics have been investigated. Over 60 distinct nuclear techniques (or variations on techniques) have been identified, most of which can be used to determine element concentrations in bulk materials, many of which have potentially significant applicability to coal analysis. The present paper highlights and summarizes some of the more important substantive content abstracted from an extensive and detailed report of the investigation. 9 references, 6 tables.

32541 **(CONF-840805—14) Factors influencing trace element variation in U.S. coals.** Lindahl, P.C.; Finkelman, R.B. (Argonne National Lab., IL (USA); Exxon Production Research Co., Houston, TX (USA)). 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012097.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

In this paper, the authers made several broad generalizations regarding factors that influence trace element variations. They urge that in interpretative work these generalizations be applied carefully. A critical evaluation of existing trace element data would probably result in identification of anomalous values and elimination of suspect data. Several questions might be answered by such an evaluation; for example, do the two K values in the high-ash region of Figure 1 deviate signeificantly from the trend of the other data because of analytical errors or recording errors. Are they legitimate geochemical anomalies. Analytical chemists and geologists are urged to interact closely because this is one of the best ways to improve the quality of analytical methodology and data, and geological interpretation. The nature of trace element variations, for whatever cause, highlights the need to more judiciously select representative samples for reliable quantitative analyses. Statistical techniques, such as principal component analysis, should help in resolving the influence of the factors affecting trace element variations in coal. It is hoped that this paper will encourage more detailed study of factors influencing trace element variations in coals. 19 references, 3 figures, 4 tables.

32542 **(CONF-840805—15) Premium coal sample program at the Argonne National Laboratory.** Vorres, K.S. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012108.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

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The purpose of the Premium Coal Sample Program is to provide the coal science research community with long term supplies of a small number of premium coal samples that can be used as standards for comparison. The premium coal samples produced from each coal and distributed through this program will be as chemically and physically identical as possible, have well characterized chemical and physical properties, and will be stable over long periods of time. Coals will be mined, transported, processed into the desired particle and sample sizes, and packaged into environments as free of oxygen as possible. Humidity will also be controlled to keep the coals as pristine and in as stable of a condition as possible. Initial samples are expected to be available in fall, 1984. Samples will be made available to research personnel at a nominal replacement cost. Each recipient of samples is asked to provide either a literature reference to papers in widely circulated journals, or a copy of less widely circulated reports and papers, to be shared with other users of the samples. Listings of these references will be available on request to the author either in printed versions or via computer terminal. The Premium Coal Sample Program expects to work with other coal sample programs in providing samples and sharing information. Following the reports from the use of a number of samples, workshops are planned to facilitate sharing research results and to foster basic understanding of the chemistry and physical properties of the coal.

32543 **(CONF-8405154—5-Draft) Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry.** Wilson, J.H.; Mrochek, J.E.; Johnson, J.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012359.

From American Institute of Chemical Engineers spring national meeting; Anaheim, CA, USA (20 May 1984).

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Thermal conductivities of a Wilsonville solvent and of a slurry prepared from this solvent and Illinois No. 6 coal have been measured at temperatures from 295 up to 500 K. With increasing temperature, the thermal conductivity varied from 1.23 to 1.02 mW cm^{-1} K^{-1} (296 to 438 K) and from 1.51 to 1.02 mW cm^{-1} K^{-1} (295 to 505 K) for the solvent and the slurry, respectively. At room temperature, measurements on toluene were accurate to within 3% of literature values. 18 references, 9 figures, 7 tables.

32544 **(DOE/METC—84-8, pp 3-15) X-ray computerized tomography of coal.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19210.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

X-ray computed tomography (CT) is being used to investigate the internal structures of as-mined coal and of coal as it is being processed. In particular, experiments are planned to image the devolatilization, pyrolysis, and combustion of coal as it occurs inside a furnace mounted within a CT machine. The X-ray CT machine nominally gives an image of the electron density distribution within an object. This has not been a classical way of describing coal; and therefore, the first stages of this investigation involve the development of an understanding of the relationships between CT images and the more classical descriptions of coal, its petrography and porosity. Experimental results to date strongly suggest that the CT technique has adequate density resolution to distinguish and determine petrographically interesting species. In studying coal porosity, considerable computer programming has been necessary to obtain reasonable images of xenon in coal. However, preliminary results show that xenon does not penetrate uniformly in the coal, that the pattern of the gas flow in the direction of the bedding planes is quite different to that across the planes, and that the preferential regions for gas penetration is into regions that appear to be high in mineral matter. 2 references, 5 figures, 2 tables.

32545 **(DOE/PC/30013—F9) Data base for the analysis of compositional characteristics of coal seams and macerals. Final report, Part 9. Interaction of gases, vapors and liquids with coals and macerals at ambient temperatures: their use to characterize porosity.** Walker, P.L. Jr.; Davis, A.; Verma, S.K.; Rivera-Utrilla, J.; Khan, M.R. (Pennsylvania State Univ., University Park (USA)). May 1984. Contract AC22-80PC30013. 89p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84012698.

The interaction of Hg, He, CO_2, water, and methanol at room temperature with a wide variety of -20 mesh American coals and 45 maceral concentrates has been studied. This interaction has been used to characterize porosities in these coals and macerals. Displacement of Hg and He, from which densities of coals and macerals in these fluids were calculated, has been measured. Exposure of coals and macerals to these fluids results in little change in their structure. Hence, pore volumes calculated to be accessible to He from density data, are taken as true values. Pore volumes accessible to CO_2, water, and methanol frequently exceed those accessible to He, despite its being a smaller molecule. This is attributed to the swelling of coals in the presence of CO_2, water, and methanol due to a combination of adsorption on the walls of micropores and imbibition into the solid structure. Swelling in water and methanol was confirmed on many coals and macerals using a combination of fluid densities, as measured by use of a pycnometer, and fluid uptake, as measured gravimetrically. Swelling of coals and macerals in water and methanol increases significantly with decreasing rank. Expansion of beds of coal and maceral particles was measured in CO_2 and methanol using a dilatometer. Expansion in CO_2 increases sharply as CO_2 partial pressure (activity) is increased from 0.016 to 0.76. For coals of higher rank, expansion in CO_2 and methanol, at equivalent relative pressures, are similar. On the other hand, for coals of high volatile bituminous and lower ranks, expansion in methanol is considerably higher than that in CO_2. The swelling of coals in different fluids is expected to have a profound influence on the rheology of the fluids. This has implications when coal-liquid slurries are used in combustion and gasification processes. 33 references, 16 figures, 19 tables.

32546 **(DOE/PC/60791—2) Solid state NMR methods for coal science. Progress report, January 1-March 31, 1984.** Zilm, K.W. (Yale Univ., New Haven, CT (USA). Dept. of Chemistry). Apr 1984. Contract FG22-83PC60791. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013178.

This report covers the progress made on the title project. The solid state NMR spectrometer has been completed and test results are presented. A number of alternative probe circuits have been evaluated for our solid state work. One has been found to be particularly efficient in use of decoupling power. Some progress has also been made in construction of a magic angle spinner for our probes as well. 2 figures, 1 table.

32547 **(ECN—83-174) Trace elements in imported coal.** van der Sloot, H.A.; Zonderhuis, J.; Mey, R. (Stichting Energieonderzoek Centrum Nederland, Petten). Oct 1983. 22p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The results of many coal samples analysed at ECN are compiled. The samples are representative for coal imported for Netherlands utility plants. Trends can be given for marine or fluvial origin of the coal. Generally there is less variability in trace elements in one load of coal.

32548 **(ECN—83-179) Combustion properties of oxidized and weathered coals in a fluidized bed.** Vleeskens, J.M. (Stichting Energieonderzoek Centrum Nederland, Petten). Nov 1983. 21p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Gentle pre-oxidation of bituminous coals did not markedly influence their combustion behavior in a fluidized bed. Neither the amount of unburnt matter nor the final burnout diameter of the char particles changed through oxidation. Also, the vitrinite reflectance was the same before and after oxidation, as could be expected. Therefore, a previously reported correlation between rank and combustion efficiency is also valid for slightly oxidized coals. Natural weathering, however, showed a serious decrease of combustion efficiency. It is concluded that such deterioration is not related to changes in oxygen content or swelling properties.

32549 **(MLM—3151) Activities of isotopes of uranium, thorium, radium, and lead of Antarctic coals.** Gilbert, G.E.; Casella, V.R.; Bishop, C.T. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 11 Jun 1984. Contract AC04-76DP00053. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013541.

Five coal samples from the Transantarctic Mountains of Antarctica were analyzed for the primordial radionuclides uranium-238, thorium-232, and uranium-235, the parents of the naturally occurring uranium, thorium, and actinium disintegration series, respectively. In most of the samples, the radionuclides uranium-234, thorium-230 radium-226, and lead-210 of the uranium series and radium-228 and thorium-228 of the thorium series were also measured and found to be in secular equilibrium with their parents. Activities of uranium-238, thorium-232, and uranium-235 ranged from about 0.1 to 1.0 pCi/g, 0.09 to 1.1 pCi/g, and 0.006 to 0.06 pCi/g, respectively. These results are comparable to corresponding activities reported for United States coals. 10 references, 3 tables.

32550 **(PB—84-179183) Photoacoustic microscopy of coal macerals. Annual report Jan-Dec 83.** Johnson, K.W.; Telschow, K.L.; Crelling, J.C. (Southern Illinois Univ., Carbondale (USA)). Jan 1984. 41p. NTIS, PC A03/MF A01.

See also PB83-195123.

The overall objective of the project is to develop photoacoustic microscopy as a new, in situ technique for delineating the thermal and chemical properties of coal macerals. This petrographic information is expected to play a role in the characterization of coal for any process where the properties of the coal determine the behavior of the process. To characterize coal properly, both its chemical composition and its thermal properties must be known. Photoacoustic microscopy offers a potentially useful technique for probing the thermal-conductance and thermal-elastic properties of coal macerals. Coupled with the traditional reflectance measurements, which yield information about the optical properties of macerals, photoacoustic microscopy is expected to produce a more comprehensive classification of the properties of macerals. The major result achieved has been the development of a photoacoustic/reflectance microscope capable of obtaining thermal and optical data from the same coal macerals. The data shows that there are significant differences between the thermal properties of vitrinite and pseudovitrinite macerals. The differences are especially prominent for low rank coals, such as Hi-Vol A, and gradually disappear in the higher rank coals beginning with semi-anthracite. It is shown that the photoacoustic data compliments existing reflectance data when used for coal characterization.

32551 **(STF—15A83025) Peat in Nord-Troendelag. A survey of the selection of products and the production methods.** Nilssen, E.; Groenning, A.; Karlsvik, E. (Trondheim Univ. (Norway). Vassdrags- og Havnelaboratoriet). May 1983. 106p. (In Norwegian). NTIS (US Sales Only), PC A. Order Number DE84751025.

Paper copy only, copy does not permit microfiche production.

The report discusses the possibilities for future use of the peat resources in the county of Nord-Troendelag. Different types of agricultural and fuel peat are the most interesting products. A number of different methods for taking out and drying peat are mentioned and considered. A survey of the sales possibilities for fuel peat in the county is made. Private consumers, official buildings, businesses, green houses and district heating installations would be possible consumers. 24 drawings, 9 photos, 22 tables.

32552 **(VTT-TUTK—232) Development of sampling method for milled peat.** Impola, R.; Okkonen, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Nov 1983. 82p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

The price of peat is generally determined by its energy content which again depends on the moisture of peat and the heat value of dry peat. To determine these qualities we have to take samples of peat. Sampling is now made manually. Consequently the errors caused by human factor can be disproportionate large. We can avoid systematic errors in sampling by developing automatic sampling and sample handling methods. However, as manual sampling is not to be abandoned in the near future, we have in the investigation sought optimum solutions also for this sampling method. The number of samples, volume of sample, sampling place and method and handling of samples have been evaluated. By making the manual sampling as systematic as possible we can reach better results. One object for study was the moisture distribution of the milled peat layer on a conveyor belt, primarily as a function of belt width. The differences in moisture distribution observed were so large that when samples are taken from a moving peat flow the sample must represent the cross section of the whole peat flow. When samples are taken directly from the load, it is difficult to obtain representative samples. We investigated how a sampling tube operated with compressed air functions and how reliable the peat samples were. It was found that the peat samples did not dry significantly during sampling. Sampling by compressed air can be considered one alternative when we proceed to use automatic and mechanical sampling systems. The investigation presents a proposal on manual or mechanical sampling in power plant. Mechanical sampling is the most recommendable. However, it is difficult to achieve in peat deliveries. To follow the basic principles of sampling is even in mechanical sampling almost impossible when there are several suppliers and when quality control has not been considered in plant design.

0108 Waste Management

REFER ALSO TO CITATION(S) 32459, 32638, 34236

32553 **(CONF-8405196—1) Dry scrubbing at Argonne's 20MW boiler.** Farber, P.S. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013457.

From 82. annual convention of the National Lime Association; Charleston, SC, USA (17 May 1984).

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Argonne has had in operation for the last two years a high-sulfur dry FGC system. (1) We have successfully demonstrated that reliable, economical, removal of sulfur dioxide at, and above, the levels dictated by the NSPS is possible. (2) It has been shown that a lime-based spray dryer can perform successfully in a retrofit

mode, removing 70% of the inlet SO_2. (3) System economics based on actual operation have been ascertained, and seem to be in line with published estimates. (4) Waste studies have indicated that there is a dependence of pH upon leachate concentration but, no concentration of elements were high enough to classify wastes from a dry scrubbing system as hazardous. 7 figures, 4 tables.

32554 **(DOE/FE/60181—23) Gasifier wastewater treatment: Phase I cooling tower assessment.** Mann, M.D.; Willson, W.G.; Hendrikson, J.G.; Winton, S.L. (North Dakota Univ., Grand Forks (USA). Energy Research Center; Radian Corp., Austin, TX (USA)). 1984. Contract FC21-83FE60181. 37p. (CONF-840828—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007671.

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

The principle goal of the gasification research at UNDERC is to develop environmental data on the treatability of wastewaters from the fixed-bed gasification of lignite. Research activities are focused around the cooling tower, where the reuse of treated gasification wastewaters has not been demonstrated in this country. The objective of Phase I cooling tower testing was to evaluate the effectiveness of using minimally treated wastewater (solvent extracted and steam stripped - referred to as stripped gas liquor) as makeup to a cooling tower. Ammonia, alkalinity, phenol, and other non-hydantoin organics were removed from the cooling water by stripping and/or biological degradation. Foaming of the circulating water will be a problem using SGL as makeup and foaming control will be required. The SGL feed cooling system supported a high level of biological activity (1 to 10 million/ml). Pseudomonas aeruginosa was identified as the predominant specie in the system. Severe fouling can be expected for all carbon steel surfaces. Fouling of stainless steel was not a major problem. General corrosion rates of 10 to 24 mils/yr were measured for carbon steel in various parts of the system. Carbon steel heat exchanger tube analysis indicated pitting corrosion penetration rates of 20 to 125 mils/yr under deposits. Computer analysis also indicated a strong potential for scaling from calcium carbonate precipitation. Results from this study indicate that the use of stripped gas liquor similar to that produced by the UNDERC pilot gasifier as cooling tower makeup is limited by a number of potentially serious operating problems. This water could be used for cooling tower makeup only after additional treatment or possibly with the use of biocides, corrosion inhibitors, and other control methods. 12 references, 6 figures, 7 tables. (DMC)

32555 **(DOE/FE/60181—50) Treatment of coal gasification wastewater using rotating biological contactors.** Wernberg, K.B.; Strain, J.H.; Turner, C.D.; Gallagher, J.R. (North Dakota Univ., Grand Forks (USA)). Jun 1984. Contract FC21-83FE60181. 22p. (CONF-840749—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013302.

From 2. international conference on fixed-film biological processes; Arlington, VA, USA (10 Jul 1984).

Reuse of coal gasification process water for makeup cooling tower water requires physical, chemical and biological treatment to prevent excessive corrosion and bio-fouling in the tower. Pretreated wastewater contains about 2100 mg/l BOD, 5800 mg/l COD, 2000 mg/l TOC, 560 mg/l ammonia, 30 mg/l cyanide, 190 mg/l thiocyanate, 180 mg/l phenols, and 1700 mg/l hydantoins. Single-stage RBC treatment was effective in biotreatment of this wastewater even though feed strength was highly variable. Removals at a hydraulic loading of 1 gpd were 94% for BOD, 33.8% for COD, 33% for TOC, and 100% for phenols. Ammonia, thiocyanate, cyanide and hydantoins were not removed to any significant degree in this system. 6 references, 10 figures, 4 tables.

32556 (DOE/METC—84-8, pp 358-367) **Treatment of coal gasification process wastewater.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objectives of this program are to assess treatment requirements and develop control strategies for wastewater from coal gasification processes in order to ensure the availability of effective and economical environmental controls. The series of investigations reported here provides information useful in the design of physicochemical wastewater treatment operations and the incorporation of these units in an integrated train for the treatment of coal gasification process wastewaters. The investigations discussed include: (1) a study of the effect of solvent extraction on the operation of a biological treatment system and subsequent polishing steps; (2) a determination of the effectiveness of the ozonation of biologically treated wastewater; and (3) a study of the use of wet air oxidation for the treatment of these wastewaters. The wastewater treatment program at PETC has provided data from bench-scale evaluations of various wastewater treatment unit operations and processes documenting the effectiveness of these environmental controls and providing useful information for the design of large-scale facilities. 3 figures, 3 tables.

32557 (DOE/METC—84-8, pp 368-380) **Environmental studies - fixed-bed gasification.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective is to: (a) operate a wastewater treatment system, including a cooling tower simulation unit, in a manner approximating that intended for the Great Plains Gasification Associates (GPGA) commerical plant; (b) determine the environmental and process consequences of using minimally pretreated wastewater in cooling tower; and (c) provide for contingency testing of an activated sludge treatment step, if required. The initial wastewater treatment process being studied, consists of tar/water separation, phenol extraction, ammonia stripping with concentration in the cooling tower, and disposal in incinerator. An optional treatment step is biological treatment with possible addition of powdered activated carbon. The effluent treated in the pilot plant is from gasification of the same lignite as being used by GPGA, the difference being that GPGA gasifiers are dry bottom Lurgi while UNDERC uses a slagging unit. The first coolig tower test was initiated on March 31, 1983, and was completed May 26, 1983. Results are discussed. Preliminary conclusion is that minimal treatment of UNDERC-SFBG wastewater is inadequate for use as feed to the cooling tower. 4 figures, 5 tables.

32558 (DOE/METC—84-8, pp 381-385) **Fixed-film fluidized-bed bioreactors for biooxidation of coal converison wastewaters.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The program to develop and evaluate the fixed-film, fluidized-bed bioreactor for treatment of coal gasification wastewaters consists of the following major tasks: design and construct a laboratory-scale bioreactor system, develop a synthetic feed for initial studies, establish a suitable culture of fixed-film microorganisms, and determine appropriate conditions for steady-state operation of the bioreactor; (2) assess the performance of the bioreactor in terms of degradation of phenolics and develop mathematical models for process evaluation, reactor design, and scale-up studies. Compare performance with conventional biooxidation systems using published data. Validate initial conclusions using complex and/or real wastewaters; (3) design and construct a 1-gpm system and evaluate performance with field tests or with real wastewaters transported to Oak Ridge National Laboratory. Typical operating data of bioreactor performance are presented in Table 1. Results show that effluents with phenol concentrations < 1 mg/L can be obtained in this reactor with influent phenol in the 30 mg/L range. This result and kinetic batch studies indicate that higher phenol concentrations could probably be reduced to <1 mg/L by using a longer residence time. 2 tables.

32559 **(EPS—3-WP-82-4) Characterization and treatability of drainage samples from coal piles at steam electric power stations.** (Environment Canada, Ottawa, Ontario. Environmental Protection Service). 1982. 159p. Environment Canada, Environmental Protection Service, Ottawa, Ontario.

A literature review of the nature and characteristics of drainage water from outdoor coal stocks indicated that in eastern Canada the drainage was frequently highly acidic, with elevated

concentrations of dissolved iron and heavy metals; western Canadian coals, which contain less sulphur, produced a drainage water with lower amounts of metals and trace elements, a more neutral pH, but higher suspended solids contents. Coke pile drainage, by contrast, was slightly alkaline with appreciably lower concentrations of both organic and inorganic substances. Samples from coal piles at 5 coal-fired generating plants and 2 coke plants at steel mills were analysed to assess their susceptibility to treatment. The most cost-effective treatment for drainage water from eastern coal piles consisted of pH adjustment with lime and the addition of an anionic polyelectrolyte as a coagulant aid. Successful treatment of western coal pile drainage involved the addition of either lime or calcium chloride as the primary coagulant, addition of polyelectrolyte being required occasionally to improve settling.

32560 (INIS-mf—8861, pp 389) **Experiences with zirconium dioxide measuring cells for oxygen concentrations in flue gases.** Siemer, K. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

Solid-electrolyte analyzers are increasingly applied for O_2 analysis in flue gases. The measuring probe is often installed in the flue while the electronic components can be as far as 100 m away. ZrO_2, a ceramic material, is electrically conductive at temperatures beyond 600°C. At these temperatures, oxygen ions move freely in the crystal lattice. By separating two gas volumes by a small ZrO_2 plate with porous platinum electrodes and heated to more than 600°C, a voltage U can be measured between the electrodes. This voltage U, as described by the Nernst equation, is a function of temperature and of the oxygen partial pressures.

32561 (INIS-mf—8861, pp 389) **Measuring methods in a flue gas desulfurization plant.** Ronig, H.W. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

A flue gas desulphurisation plant (Scholven F) is described, i.e. circuits, methods of measurement and measuring instruments. Experiences with different measuring systems are presented.

32562 (IS-T—1095) **Granulation of nomagnetic fly ash-coke mixtures.** Feisel, B.C. (Ames Lab., IA (USA)). Jun 1984. Contract W-7405-ENG-82. 119p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013912.

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The granulation of different nonmagnetic fly ash-coke mixtures with subsequent heat treatment and reaction was investigated. Conclusions of this study are: (1) adjustment of the pan granulator machine variables produced a variety of granule sizes, but did not provide adequate granule strength for these mixtures; (2) percent addition of additives to increase granule strength was found to exceed that which would make their use economical; (3) granule strength increased with increasing firing temperature in an inert or an oxidizing atmosphere; (4) firing in an oxidizing atmosphere produced granules of much greater strength than firing in an inert atmosphere; (5) granule strength increased with increasing firing time in an inert or an oxidizing atmosphere; (6) unfired and inert fired granules were determined to be homogeneous throughout with respect to carbon and other major elements; (7) carbon content decreased with increasing firing time in an oxidizing atmosphere until finally dropping to nearly zero; (8) granule strength increasing linearly with granule size; (9) granule strength increased with decreasing particle size of the feed mixture; (10) a sintering mechanism by which particles melt at the points of content and small pores are closed accounted for the increased granule strength upon firing; (11) granules fired in an oxidizing atmosphere were found to consist of an outer shell lacking in carbon particles which increased with firing time; (12) granules were quite porous before and after firing; (13) chlorination performance of granules was as good as that of loose mixtures of fly ash and coke; (14) carbon to ash ratio was not a controlling variable over the range studied for the powder or the granule chlorinations; and (15) granule strength was found to decrease with the degree of conversion, but was still sufficient for maintaining bed integrity and for handling. 80 references, 42 figures, 10 tables.

32563 **(PB—84-158724) Mccallum study area: resource and potential reclamation evaluation. Final report.** (Water and Power Resources Service, Denver, CO (USA)). Sep 1983. 307p. (R—26-79). NTIS, PC A14/MF A01.

See also PB84-158716. Sponsored in part by Geological Survey, Denver, CO.

The purpose of this investigation was to collect baseline data for establishing reclamation objectives and lease stipulations. The report includes data on climate, biological and cultural resources, physiography, geology, coal resources, soil overburden, vegetation, and hydrology. The study area is within Moffat County in Colorado.

32564 **(PB—84-161470) Development of criteria for extension of applicability of low emission, high efficiency coal burners. Annual report Sep 77-Sep 78.** Brienza, A.; Chen, S.; Heap, M.; Lee, J.; Nurick, W. (Energy and Environmental Research Corp., Irvine, CA (USA)). Feb 1984. 192p. NTIS, PC A09/MF A01.

See also PB82-197153.

The report gives results of the first year's effort on this contract. Experimental studies were conducted at three scales to determine the influence of coal properties on NOx emissions. In addition, the use of sorbents to reduce SOx emissions from coal flames was investigated. Bench-scale (0.1 million Btu/hr) investigation concentrated on studies to define the effect of coal characteristics on fuel nitrogen conversion. Based on these investigations, the total coal nitrogen content does not appear to be the primary variable controlling fuel NO production in pulverized-coal flames. Experiments were conducted with research-design low-NOx burners at two scales (12.5 and 100 million Btu/hr) using three coal types. Under optimum conditions, the NOx emissions, typically below 200 ppm (dry at 0% O_2), were only slightly dependent on coal characteristics. Preliminary investigations assessed the use of the low-NOx burner design to reduce NOx and SOx emissions by adding sorbents to the coal before the pulverizer. Limestone added this way gave 50, 70, and 80% reductions in SO_2 emissions at calcium/sulfur molar ratios of 1, 2, and 3, respectively.

32565 **(PB—84-162890) Experimental and engineering support for the CAFB (Chemically Active Fluid-bed) demonstration: residue disposal/utilization. Final report 1979-82.** Peterson, C.H.; Ulerich, N.H.; Newby, R.A.; Keairns, D.L. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Feb 1984. 124p. NTIS, PC A06/MF A01.

The report gives results of an investigation of the disposal and utilization of spent sulfur sorbent from the Chemically Active Fluid-bed (CAFB) process. Lignite ash with a minimum of 10% CaO can be used as a replacement for sand or medium aggregate or as a partial replacement for light aggregate in cement block manufacturing with higher strengths (14.68 to 26.82 MPa) than standard mixes, 4.62 to 5.62 MPa at 28 day cure tests. This indicates that the cement content of the mix may be reduced when CAFB residue is used. Disposal tests indicate that pH, calcium, and sulfate in the leachate are primary environmental concerns. Some lignites and coal may produce levels of trace materials (e.g., selenium, iron, and manganese) that exceed regulations. Any appreciable sulfide in the spent sorbent must be converted to sulfate before disposal. Fine particle size, possibly as small as -44 micrometers, appears necessary for complete conversion of the calcium sulfide to calcium sulfate in completely sulfided sorbent. Cementitious compounds may be formed under CAFB operating conditions, thus aiding disposal and reducing leachates from the spent sorbent.

32566 **Adsorption-enhanced biogasification of coal conversion wastewater.** Harper, S.R.; Cross, W.H.; Pohland, F.G.; Chian, E.S.K. (Georgia Inst. of Tech., Atlanta). *Biotechnology and Bioengineering Symposium;* No. 13, 401-420(1983). (CONF-830567—).

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Activated carbon adsorption has been observed as instrumental in maintaining environmental conditions conducive to biological conversion of coal-gasification wastewater. The relationship between adsorption and biodegradation was studied in a series of

reactors and in a singular reactor to which fresh carbon was added periodically. The potential for improved biological conversion of the relatively refractory wastewater has been demonstrated and preliminary data have been extended to suggest design and operational strategies. 10 references, 9 figures, 8 tables.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 32623, 32624, 32625, 32626, 32627, 32628, 32629, 32630, 32631, 34246

32567 **(DOE/BP—255) Economic analysis of the environmental effects of the coal-fired electric generator at Boardman, Oregon. Final report.** (ECO Northwest (USA)). 29 Dec 1983. Contract AC79-83BP11551. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013682.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

This study is one of several commissioned by the Bonneville Power Administration (BPA) to estimate the economic value of the environmental costs and benefits of different electricity-generating resources. In it we described and quantify the environmental costs and benefits of coal-fired generators, using the plant in Boardman, Oregon, as the basis for our estimations. The Boardman plant uses pulverized coal to produce steam for generating electricity. It is nominally rated at 550 megawatts. This study assumes a 70% load factor and an annual production of 3373 x 10^6 kWh. Cooling water comes from a 1400-acre cooling pond; coal comes from Wyoming in 100-car unit-trains every two days. The estimated service life of the plant is 40 years. We developed a socioeconomic-environmental model to assess the final physical impacts of each of the initial impacts resulting from the fuel cycle. The analysis of environmental effects comprises four steps: (1) identify all the potential environmental impacts stemming from the entire fuel cycle associated with the plant; (2) determine which effects warrant detailed economic analysis; (3) complete the economic analysis for the effects selected in step 2; and (4) estimate the extent to which the results of the case study apply to other potential plants using the coal-fuel cycle. 102 references, 5 figures, 10 tables.

32568 (EPRI-CS—3182-Vol.1, pp 2.1-2.12) **Utility perspective on NO/sub x/ control.** Goodman, C.H. (Southern Co. Services, Inc., Birmingham, AL). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The status of legislative and regulatory activities that could require further NO/sub x/ emission reductions from existing and/or new coal-fired power plants are reviewed. Revised ambient air quality standards, visibility protection requirements, revisions of New Source Performance Standards, application of Prevention of Significant Deterioration requirements, and acid deposition legislation will be discussed. When possible, comments will be made concerning the need for investing R & D resources in further NO/sub x/ control research. 4 figures.

32569 (EPRI-CS—3182-Vol.1, pp 4.1-4.22) **Status of NO/sub x/ controls for Riley Stoker wall-fired and turbo-fired boilers.** Lisauskas, R.A.; Rawdon, A.H. (Riley Stoker Corp., Worcester, MA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Large pilot scale and full size field data are presented on a new low NO/sub x/ retrofit burner design for pulverized coal wall-fired boilers. NO/sub x/ reductions of 50 to 60 percent have been achieved with this retrofit burner on three large (greater than 300 MW) utility boilers. An update of Turbo furnace NO/sub x/ controls is also given. NO/sub x/ field results are presented on the effects of underfire air and variable direction coal spreaders. In addition, the results of pilot scale burner aerodynamic tests are discussed, and the effects of staged combustion on furnace heat transfer are predicted. 9 references, 20 figures, 2 tables.

32570 (EPRI-CS—3182-Vol.1, pp 8.1-8.22) **Long term optimum performance/corrosion tests of combustion modifications for utility boilers.** Ferraro, J.M.; Natanson, P.S.; Vaccaro, R.M. (Exxon Research and Engineering Co., Florham Park, NJ). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Field testing is being conducted to evaluate emissions and corrosion at coal-fired utility boilers designed to meet New Source Performance Standards. This work, an extension of similar programs sponsored by the EPA, is intended to evaluate the long term emissions and corrosion effects of combustion modifications instituted primarily for NO/sub x/ control. The work effort of this program is being accomplished in several phases. The first phase consists of preparation and performance of a detailed test matrix designed to provide a thorough characterization of combustion modification (overfire air, low excess air, etc.) techniques applicable to each unit. This results in recommended low NO/sub x/ operating conditions for long term testing. Then, during the long term testing, major emphasis is placed on quantitative measurement of furnace tube wall corrosion under low NO/sub x/ firing conditions. This is accomplished through evaluation of short term (corrosion probe) test results as well as scheduled long term water wall tube thickness measurements inside the boiler. Other work performed during the long term test period has included Level 1 environmental assessment testing with physical, chemical, and biological analysis of various effluent streams. Flue gas analysis includes measurement of NO and NO/sub x/, CO, CO_2, O_2 and SO_2/SO_3. Particulate grain loading, size distribution and precipitator capture efficiency are also being evaluated. In addition, several 30-day continuous monitoring tests (NO/sub x/, O_2, CO, CO_2) will be performed at each unit. This paper discusses the results and status of work performed thus far. 7 references, 6 figures, 8 tables.

32571 (EPRI-CS—3182-Vol.1, pp 9.1-9.15) **Analysis of long-term NO emission data from pulverized coal-fired utility boilers.** Cherry, S.S. (KVB, Inc., Irvine, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Long-term NO emission monitoring data obtained from nine pulverized coal-fired utility boilers were analyzed. These data were in the form of hourly-averaged NO, O_2(or CO_2) and load with NO and O_2/CO_2 being measured by certified continuous emission analyzers. The analyses were compared to the emissions limitations enumerated in both the 1971 and 1978 New Source Performance Standards (NSPS). The comparison with the 1978 NSPS showed that seven of the nine boilers would have produced no periods of excess NO emissions on a 30-day rolling average basis. In addition, the same seven boilers would have complied with the 1978 NSPS NO/sub x/ Performance test requirements. Recommendations are made to more fully analyze the operation of two of these boilers to establish if their mode of operation could be adopted by other boilers. These boilers use permanently installed CO monitors to allow operation at the lowest practical excess air to achieve either low NO emissions or better fuel efficiency.

32572 (EPRI-CS—3182-Vol.1, pp 14.1-14.38) **Status of Japanese technical development for coal combustion NO/sub x/ control.** Nakabayashi, Y.; Miyasaka, T.; Mouri, K. (Electric Power Development Co., Ltd., Tokyo, Japan). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The Electric Power Development Co., Ltd. reviewed NO/sub x/ combustion control R & D for coal-fired power plants at two previous NO/sub x/ Symposia. This third presentation mainly describes the first year operational results of the Matsushima Thermal Power Station (500 MW x 2 units) which was designed based on the results of our R & D program. The paper also concerns the

NO/sub x/ control design of the Takehara Thermal Power Station, unit No. 3 (700 MW) which is currently under construction and scheduled to start operation in March 1983. The infurnace DeNO/sub x/ process that is being developed by the Japanese boiler manufacturers as a new low-NO/sub x/ combustion technology is also briefly discussed. 8 references, 27 figures, 9 tables.

32573 (EPRI-CS—3182-Vol.1, pp 15.1-15.20) **Development of MACT in-furnace NO/sub x/ removal process for steam generators.** Takahashi, Yasuro; Sakai, Masayasu; Kunimoto, Takeshi; Ohme, Seiichi; Haneda, Hisao; Kawamura, Tomozuchi; Kaneko, Shozo. (Mitsubishi Heavy Industries, Ltd., Hiroshima, Japan; Mitsubishi Heavy Industries, Ltd., Nagasaki, Japan; Mitsubishi Heavy Industries, Ltd., Tokyo, Japan). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Mitsubishi Heavy Industries, Ltd. (MHI) of Japan has developed a new NO/sub x/ reduction process in the furnace by hydrocarbons, named MACT. The first commercial application has been done in a 125 MW oil-fired boiler and the unit has been operated more than one year. The application for a industrial boiler has also been done in a 280 T/H oil fired boiler. MACT for coal fired boilers has been developed in MHI's test facilities and is ready for commercial application. 3 references, 22 figures, 3 tables.

32574 (EPRI-CS—3182-Vol.1, pp 16.1-16.18) **NO/sub x/ reduction by reburning with gas and coal: bench scale studies.** Chen, S.L.; Clark, W.C.; Heap, M.P.; Pershing, D.W.; Seeker, W.R. (Energy and Environmental Research Corp., Irvine, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Data is presented from a series of bench scale experiments in both gas and coal fired reactors to investigate the effectiveness of the reburning process for NO/sub x/ control. The results indicate that a reduction of 50 percent is possible using both gas and coal as the reburning fuel in agreement with Japanese studies. However, for reburning fuels containing high levels of fuel nitrogen, excessive quantitites of reburning fuel can cause an increase rather than a decrease in emissions. Coal properties also affect carbon burnout under reburning conditions. Further investigations are required to establish the impact of mixing rates and coal types on the reburning process and to determine the times and temperatures which must be achieved in practice for optimum NO reduction. 7 references, 11 figures, 1 table.

32575 (EPRI-CS—3182-Vol.1, pp 17.1-17.19) **Fuel staging for pulverized coal furnace NO/sub x/ control.** Kelly, J.T.; Pam, R.L.; Suttmann, S.T. (Acurex Corp., Mountain View, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

A 16.1-kW idealized subscale combustor was used to define the NO/sub x/ emission control benefits of fuel staging. NO/sub x/ control is achieved by injecting coal, as well as combustion air, at two locations in the combustor. The NO/sub x/ and combustion product gases from the first-stage flame are mixed with fuel and air in the second stage and reburned. The fuel fragments, fuel nitrogen components, soot and char produced by the reburning interact with the previously formed NO/sub x/, reducing it to low levels within a fraction of a second. This combustion modification approach has lowered NO/sub x/ by over 70 percent from baseline levels. Current test results show that second-stage stoichiometry is a dominant process variable, and that effective NO/sub x/ reduction requires that the second stage be operated fuel rich. First- and third-stage stoichiometries and fuel fraction injected into the second stage were less important to the process, as long as the second stage was operated under fuel-rich conditions. Based on the test results of this study, process variable regimes were identified where fuel staging has a distinct advantage in controlling NO/sub x/ emissions over classical staging. These are cases where the first stage is operated fuel lean and the second stage is operated fuel rich. 7 references, 8 figures, 2 tables.

32576 (EPRI-CS—3182-Vol.1, pp 19.1-19.17) **Review of in-furnace NO/sub x reduction and SO/sub x/ reduction by sorbent injection.** Breen, B.P.; Gabrielson, J.E. (Energy Systems Associates, Tustin, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The technological development of the process known variously as in-furnace NO/sub x/ reduction, reburning, and/or fuel staging is discussed. a review of past work where NO/sub x/ that had been formed in flames was subsequently eliminated by reacting with fuel is included. Work on gasifiers, combined cycles employing gas turbines with fired boilers, experimental burners, boiler simulator, a full-scale utility boiler, and cement kilns has contributed to the understanding. Various United States and foreign organizations have made contributions to the development of the process. Practical aspects of furnace design impact the pollutant reduction technologies because of limitations due to heat transfer surface, volume, and temperature requirements. How in-furnace NO/sub x/ reduction can be adapted to cyclone, tangential, and opposed-fired boilers is discussed, along with the potential impacts of individual boiler design factors and fuel characteristics. In-furnace NO/sub x/ reduction has been experimentally measured with pulverized coal, oil, or gas used as the additional fuel. Possible implementation techniques are discussed. Coal is, by far, the most economical fuel, but may restrict the technique because of primary coal transport, injection difficulty, carbon carryover, or a limited amount of NO/sub x/ reduction achieved. 9 references, 7 figures.

32577 (EPRI-CS—3182-Vol.1, pp 20.1-20.18) **Dry additive process for the reduction of SO_2 emission in brown coal fired boilers.** Hein, K.R.G. (Rheinisch-Westfaelisches Elektrizitaetswerk AG, Essen, Germany). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

A flue gas desulfurization process using dry calcium-based materials as additives with the fuel has been proposed based on the results of combustion trials with Rhinish brown coals. The applicability of the process was evaluated in a brown coal fired utility boiler (175 ton/hr steam production) over several years. The first results of this project were published in 1978 (1) and 1981 (2). In the meantime, a detailed research program has been carried out in order to reduce the amount of additive necessary to provide a given SO_2 reduction. 3 references, 11 figures.

32578 (EPRI-CS—3182-Vol.1, pp 21.1-21.21) **Operation and performance report of the Steinmueller low NO/sub x/ SM-burner and its potential towards utility boiler SO/sub x/-control via sorbent injection.** Chughtai, M.Y.; Michelfelder, S.; Leikert, K. (L & C Steinmueller GmbH, Gummersbach, Germany). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Following the successful pilot plant tests the combustion equipment of a 700 MW coal fired power station was changed to staged mixing burners (SM-burners). Both, to ease the retrofit and to safely allow the execution of a measuring program as retrofit burners a modified version of the experimentally optimized SM-burner design was used for the boiler. In spite of the narrower operational limits of the modified SM-burner the goal of a 50 % NO/sub x/ reduction was met in the boiler demonstration tests. Furthermore a burner load dependent automatic secondary/tertiary air flow control system developed to guarantee a safe burner operation at low NO/sub x/ levels over a wide turn down ratio, was introduced successfully. In the past 42 months of operation neither short term nor long term performance problems due to low NO/

sub x/ operation could be detected. Earlier successful experiments with Calcium-based sorbent addition to lignite for SO_2 absorbtion during combustion initiated a further development step for the SM-burner concept towards its application for an in situ desulfurization process. A prototype de NO/sub x/-de SO/sub x/ SM-burner has been successfully tested on a pilot scale at the International Flame Research Foundation with high calorific value fuels as coal, heavy fuel oil and natural gas. Presently a demonstration program is under way to define the potential problem areas to be taken account of in the process application for coal fired steam generators. 11 references, 9 figures.

32579 (EPRI-CS—3182-Vol.1, pp 22.1-22.19) **Low-NO/sub x/ tangential system SO/sub x/ control through sorbent injection.** Ohmine, S.; Martin, R.J.; Kelly, J.T.; Chu, E.K. (Acurex Corp., Mountain View, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

A tangentially fired, pilot-scale combustor is being used to determine the potential of a low-NO/sub x/ air-on-wall combustion modification technique to simultaneously reduce SO/sub x/ emissions through a dry sorbent injection technique. The pilot-scale facility has been designed to simulate fuel/air mixing and bulk gas heat transfer events characteristic of full-scale tangentially fired utility boilers. The results from the initial phase of the program, baseline NO/sub x//SO/sub x/ testing, are described in the paper. The baseline testing discussed here was carried out under the conventional tangential burner configuration. The gas temperature profile measured in pilot scale is shown to agree satisfactorily with full-scale data. Also, NO/sub x/ emisson levels from the pilot-scale facility are in excellent agreement with those of full scale. Dry sorbent injection tests were conducted to show the effect of SO/sub x/ reduction as a function of sorbent injection concentration, excess air, furnace load, sorbent injection location, sorbent type, and coal type. The trends observed in the dry sorbent injection tests are consistent with past studies. Actual SO/sub x/ reduction levels achieved are also similar. The effect of overfire air addition on dry sorbent injection is briefly discussed. 21 references, 17 figures.

32580 (EPRI-CS—3182-Vol.1, pp 23.1-23.34) **Feasibility of furnace injection of limestone for SO_2 control.** Kokkinos, A.; Lewis, R.D.; Borio, D.C.; Plumley, A.L.; McElroy, M.W. (Combustion Engineering, Inc., Windsor, CT; Electric Power Research Inst., Palo Alto, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

A four-phase program under EPRI sponsorship to determine the engineering and economic feasibility of dry sorbent injection for control of sulfur dioxide emissions has been completed. A survey of available literature on dry sorbent injection for sulfur control was performed which was supplemented by laboratory ash fusion temperature tests of selected coals at several Ca/S ratios. The information generated from these studies formed the basis for an engineering feasibility and an economic impact analysis for both new and retrofit utility boiler applications. An analysis of sixteen case studies was performed relating Ca/S and coal sulfur content to boiler design and dry sorbent system costs. The analysis showed that dry sorbent injection is feasible from an engineering point with levelized costs of 1 mills/kWh to 14 mills/kWh depending on the coal sulfur content and the Ca/S molar ratio. 11 figures, 4 tables.

32581 (EPRI-CS—3182-Vol.1, pp 24.1-24.15) **IERL-RTP research on sulfur capture in LIMB.** Borgwardt, R.H.; Gillis, G.R.; Roache, N.F. (Environmental Protection Agency, Research Triangle Park, NC; Northrop Environmental Services, Inc., Research Triangle Park, NC). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

EPA's in-house laboratory studies of gas/solid reactions that are expected to contribute to sulfur capture in the limestone injection multistage burner (LIMB) is discussed. The research is aimed at an improved understanding of variables that determine the rate of reaction and ultimate conversion of limestone when injected into the reducing or oxidizing zone of the burner. Current work is focused on reactions which may occur in the first stage of the LIMB to form CaS. Initial results of bench-scale studies using differential and entrained-flow reactors are presented, including the reaction of H_2S with $CaCO_3$, the calcination of $CaCO_3$ to CaO, and the reaction of H_2S with CaO. 7 references, 14 figures.

32582 (EPRI-CS—3182-Vol.1, pp 28.1-28.20) **Evaluation of NO/sub x/ and NO/sub x//SO/sub x/ flue gas treatment technology for coal-fired sources.** Mobley, J.D.; Burke, J.M. (Environmental Protection Agency, Research Triangle Park, NC; Radian Corp., Austin, TX). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Nitrogen oxide (NO/sub x/) emissions from stationary sources may be reduced by 80 to 90 percent through the application of selective catalytic reduction (SCR) of NO/sub x/ with ammonia (MH_3). For the most part, SCR has been developed and commercially applied in Japan. In the interest of evaluating SCR technology in the US, EPA has sponsored pilot-scale tests of two SCR systems treating flue gas from coal-fired boilers. The processes tested were the Hitachi Zosen process and the Shell Flue Gas Treatment (FGT) process, which also removes sulfur dioxide (SO_2). The results of those tests show that both processes tested are technically capable of reducing 90 percent of the NO/sub x/ in flue gas which contains the full particulate concentration from a coal-fired boiler; however, the performance of the Shell process was generally below this level. A sampling program conducted during the pilot plant tests showed no adverse secondary emissions from application of the SCR processes; however, high NH_3 and sulfur trioxide (SO_3) emissions are a concern due to their potential for causing operational problems in downstream equipment. Cost projections, which are based on pilot plant results, show that the Hitachi Zosen process combined with a conventional flue gas desulfurization process should cost less than the Shell process for control of both NO/sub x/ and SO_2 emissions. 3 references, 2 figures, 7 tables.

32583 (EPRI-CS—3182-Vol.1, pp 30.1-30.10) **Catalytic DeNO/sub x/ demonstration system Huntington Beach Generating Station Unit 2.** Kerry, H.A.; Weir, A. Jr. (Southern California Edison Co., Rosemead). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The Southern California Edison Company's 107.5 MW Selective Catalytic DeNO/sub x/ System is being tested to develop performance and operational data on a post combustion NO/sub x/ removal system. The unit was installed to demonstrate 90% NO/sub x/ removal. Seven months of the planned one year program has been completed. This paper reviews operational data from the system. 3 figures, 1 table.

32584 (EPRI-CS—3182-Vol.1, pp 29.1-29.22) **Current status of dry NO/sub x/-SO/sub x/ emission control processes.** Shiomoto, G.H.; Muzio, L.J.; Cichanowicz, J.E. (KVB, Inc., Irvine, CA; Electric Power Research Inst., Palo Alto, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Ammonia-based selective catalytic reduction (SCR) has been proposed as a means of reducing NO/sub x/ emissions from coal-fired utility boilers well below current federal standards. EPRI is conducting a technical evaluation of the SCR process on a 5000 scfm pilot-scale facility at the EPRI Arapahoe Test Facility. The

pilot-scale system treats a 5000 scfm slipstream of flue gas (2.5 MWe equivalent) from Arapahoe Unit 4 which fires a western low sulfur coal. In addition to the SCR reactor, the system includes a regenerative air heater to assess impacts on air heater performance. The results obtained during a one-year test program are presented. These include: (1) the process performance (NO/sub x/ removal); (2) impacts of secondary emissions, including ammonia, SO_3, and ammonium/sulfate compounds; (3) impacts of increased SO_2 levels; (4) impacts on the air preheater due to deposit buildup; and (5) evaluation of the SCR process requirements, including the ammonia injection controls, and the performance and maintenance of flue gas monitoring systems. 9 figures, 3 tables.

32585 **(VTT-TUTK—231) Emission inventory of coal, peat and oil-fired power plants.** Pohjola, V.; Hahkala, M.; Haesaenen, E. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Oct 1983. 58p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

Measurements were carried out of the emission of SO/SUB/2, NO/SUB/x fly ash, heavy metals and radioactive elements from eight power plants and district heating plants burning coal, peat or heavy fuel oil. In addition PAH-emissions were measured in the case of one coal-fired and three peat-fired plants, and the following emissions were also measured from one peat-fired plant: total hydrocarbons, aldehydes, benzene, toluene, xylene as well as the metals lead, cadmium and mercury in the gaseous phase. The mutagenicity of the stack gases was investigated using stack gas samples from one coal-fired, one oil-fired and three peat-fired plants. Samples were taken from the fuel and from both bottom ash and fly ash for elemental anlysis. Elemental concentrations of imported coal and fuel oil as well as of the peat fuel were monitored over an extended period of time. The results obtained indicated that the SO/SUB/2 emissions per unit of fuel energy in the case of oil were 2-3 times greater than the corresponding emissions from coal and as much as 6-9 times greater than from peat. Emissions of nitrogen oxides from the burning of coal were on average double those from peat and threefold in comparison with the corresponding emissions from oil. Characteristic fly ash emission from the combustion of coal was about three times greater than from peat burning. Fly ash emissions from the burning of fuel oil were about half those from coal when the fly ash collection efficiency in conjunction with coal burning was 99%. Characteristic emissions of heavy metals were greatest in the combustion of coal, with the expection of vanadium and nickel of which the greatest emissions were from oil. PAH-emissions were similar in the combustion of both coal and peat. Slight mutagenicity of the stack gases from coal- and peat-fired power plants was demonstrated.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 32539

32586 **(CSIRO-DAG-GCM—53) CSIRO horizontal borehole inclinometer - description and operation.** Gravina, J.; Carson, G.H. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1983. 18p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia.

This report describes a prototype horizontal borehole inclinometer probe, signal conditioning, and control unit. The probe is designed to operate inside AQ size (35 mm internal diameter) drill rods, has a range of +/- 40 degrees and a sensitivity of 5 minutes of arc. The novel, remote controlled, self-orientating feature of this probe enables convenient tracking of vertical displacements in horizontally drilled boreholes. In addition, the hand-held battery driven control and monitoring system has been designed as intrinsically safe for use in hazardous methane environments, making the instrument particularly suited to surveying gas drainage holes in coal mines, during the drilling process.

32587 **(PB—84-163005) Geophysical techniques for coalbed evaluation. Final report Apr 82-Dec 83.** Kern, J.W.; Sinha, A.K.; Sookram, V. (Dresser Petroleum Engineering Services, Houston, TX (USA)). Dec 1983. 111p. NTIS, PC A06/MF A01.

Methane produced from coalbeds is a potentially significant source of natural gas. The determination of gas potential will be aided if geophysical logging can determine the gas production potential of reservoirs. The purpose of this work was to define geophysical logging methods for identifying and evaluating the methane content of coals. The work was organized into the following tasks: (1) identify the instruments which define coal and coalbed methane characteristics; (2) define the expected utility of these instruments; (3) develop algorithms to assess the methane content of coalbeds; (4) coordinate logging test programs through GRI; and (5) perform field tests on wells of opportunity for verification of log interpretation methods.

32588 **(PB—84-172352) Clay-mineral assemblages in Upper Cretaceous shales in the Torreon Wash and Star Lake coal areas, southeastern San Juan Basin, New Mexico. Open file report (final).** Bodine, M.W. Jr. (New Mexico Inst. of Mining and Technology, Socorro (USA)). Dec 1983. 76p. NTIS, PC A05/MF A01.

This project was undertaken to characterize the mineralogy and chemical composition of clay mineral assemblages in Upper Cretaceous shales in the southeastern part of the San Juan Basin in northwestern New Mexico and to determine their relations with episodes of coal deposition. The shales represent a range of depositional environments from marine, through near-shore mixed marine and continental, into fluvial and aeolean continental. Coal accumulation in the Torreon Wash and Star Lake areas occurs in both mixed marine and continental and fluvial continental facies.

0120 Mining

REFER ALSO TO CITATION(S) 32586, 32637, 32645, 32646

32589 **(ACIRL-PR—83-10) Experience from initial longwalling at West Cliff Colliery.** Schaller, S. (Australian Coal Industry Research Labs. Ltd., North Ryde). Oct 1983. 57p. Australian Coal Industry Research Labs. Ltd., North Ryde.

As part of a current project conducted by Australian Coal Industry Research Laboratories Ltd. (ACIRL) to investigate feasibility design and operation aspects of longwall mining, field research was carried out at West Cliff Colliery. This report contains an analysis of the results obtained from geotechnical monitoring during a total 650 m retreat of Longwall 1. The initial geomechanical environment was established by monitoring stress changes and deformation developments in the roadways and chain pillars, and loads arising from massive overburden strata on chock-shields of 900 tonne capacity. The problems associated with high methane emissions (of the order of 50 to 150m/SUP/3/min) were greatly reduced by the existing gas predrainage system. (7 refs.)

32590 **(ACIRL-PR—83-11) Experience with initial longwalling at John Darling Colliery.** Schaller, S. (Australian Coal Industry Research Labs. Ltd., North Ryde). Oct 1983. 65p. Australian Coal Industry Research Labs. Ltd., North Ryde.

Strata response in and around Longwall 1, operating in the borehole seam, John Darling Colliery, was investigated. Brittle fracture behaviour of the roof was encountered in the gate roads. Installation and operation of two leg shields of 450 t capacity, used for the first time in Australia, was successful. Within the limitations imposed by the tectonic zones, confining the width of Longwall 1 Block to 67 m, the average longwall production was 20,000 t/week. A record production of 7806 t was achieved during one particular day and advance of 12 m in one shift. Other main features of the operations were: 1. Subsidence at the surface of less than 5% of the extraction height (of 2.4 m) proved to be no hazard to longwalling under the sea bed. 2. Yield pressures of 50 MPa were frequently recorded being the result of dynamic roof loads developed when the supporting units were moved forward. 3. The roof was sound along the face line with the Westfalia shields maintaining the settling and increased hydraulic pressures reliably. (5 refs.)

32591 **(CSIRO-DAG-GCM—51) Dual-channel microseismic monitor for use in gassy coal mines.** Carson, G.H.; Gravina, J.; Arnold, L.N. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1983. 47p. Commonwealth Scientific and Industrial Research Organization, Div. of Applied Geomechanics, Mount Waverley, Australia .

This report details the current state of development and application of a prototype dual-channel microseismic monitoring unit. This intrinsically safe unit was designed for installation at the mine face in coal mines subject to outbursts of gas and coal. The rate of microseismic emissions resulting from stress redistributions within the geological materials into which the probes of the monitor are mounted, can be analysed for characteristic signatures which may warn of an impending failure of the material. The principle of operation of the monitor, its current electronic design and the characteristics of its performance are considered in some detail. The means of collecting, recording and analysing the data are set out along with some exemplifying results from a field experiment. Some consideration is given to the next stage of development of the equipment. (3 refs.)

32592 **(CSIRO-DAG-GCM—52) Multi-stage probe for monitoring coal seam gas pressures and flows.** Skarajew, W. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1983. 7p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia.

The measurement of gas pressures and/or flows in coal seams is an essential step in the planning of coal seam gas drainage schemes. Gas drainage can help to reduce the risk of outbursts in coal mines and may represent a potentially significant source of energy. This report describes the design, construction, and proof testing of a multi-stage probe for monitoring gas pressures and flows in coal seams.

32593 **(CSIRO-DAG-TR—40) Load transfer behaviour between steel reinforcement and cement based grout.** Cox, R.H.T.; Fuller, P.G. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1977. 31p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia.

Pullout tests have been performed on single high tensile steel wires and prestressing strands embedded in columns of cement-based grout. The investigation demonstrated the significance of the grout strength and the embedment length, surface condition and external geometry of the reinforcement on the load transfer between the reinforcement and the grout. The stiffness of the grout reinforcement system under load is found to be influenced by both the surface condition of the reinforcement and the grout strength until relative movement between the reinforcement and the grout has taken place at all points along the embedded length. At this stage the load transfer also becomes dependent upon the external geometry of the reinforcement and its embedment length. As the relative displacement between the reinforcement and the grout increases, the grout strength remains a major parameter in the load transfer and the importance of the surface condition of the reinforcement diminishes.

32594 **(CSIRO-DAG-TR—41) Plug and collar anchor to transmit load from a strand to a thrust plate.** Fuller, J.G.; Cox, R.H.T. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1977. 53p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia.

A need exists for the provision of a simple device to be attached to the steel reinforcement on long bolts or dowels in order to support exposed rock in the backs (roofs) of temporary underground openings. An anchorage device for use with 12.5 mm diameter prestressing strand has been developed for this purpose. Details of the anchor design and operating principles are described and the performance of anchors of slightly different design is compared and discussed. Load transfer between 75 and 135 kN is possible with this anchorage system and support can be maintained for relative movements between the rock and reinforcement of up to 120 mm.

32595 **(DOE/FE/00016—T39) Longwall dust control field tests.** (Foster-Miller, Inc., Waltham, MA (USA)). 14 Jun 1984. Contract AI01-81FE00016. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012952.

Following are highlights of the observations and conclusions drawn from the certain field tests: The use of Kaiser's wing curtain significantly reduced the average air velocity around the face corner, particularly when the gob curtain was removed (Kaiser's existing procedure). The velocity reduction will result in a lessened tendency for headgate cutout dust to be blown directly into the walkway negatively impacting the operator's exposure. Dust will be more effectively channeled around the face corner and downstream past the shearer body. At shield No. 10, average air velocities were within 15 percent of each other over all four of the curtain configurations tested. This indicated that curtain usage had a minimal effect on airflow levels along the face for Kaiser's given condition of gob consolidation. The high air velocity (spot) readings occurring just downstream of the installed wing curtain were due to leakage through gaps in the curtain around the stageloader. The volume of leakage was not significant, but proved to be helpful in sweeping the downstream headgate region clean of contaminants and preventing recirculation. Kaiser's curtain system design has proven to be very rugged, practical and effective and would be suitable for use in many coal mines. Used in conjunction with the semipermanent stageloader curtain, the wing curtain can remain in position for nearly 30 to 40 feet of face advance before needing to be repositioned. The stageloader curtain itself could be mounted directly to the stageloader for automatic advance with headgate equipment. This would only be feasible if the headgate roof horizon was consistent. Kaiser currently hangs the curtain independently and repositions it as required.

32596 **(PB—84-159375) Development of coal-gas production simulators and mathematical models for well test strategies (computer models for single- or two-phase flow of methane and water in heterogeneous coal seams to a single, vertical production well connected to a finite conductivity vertical fracture). Topical report Aug 81-Oct 82.** Ertekin, T.; King, G.R. (United States Steel Corp., Monroeville, PA. Research Lab.). Jul 1983. 493p. NTIS, PC A21/MF A01.

Prepared in cooperation with Pennsylvania State Univ., University Park, Dept. of Mineral Engineering.

A series of unique, computer-based, finite-difference models for the production of methane from coal seams by vertical wells are presented along with FORTRAN source codes. Included in this series are single-phase (gas), one-dimensional; two-phase (gas-water), one-dimensional; and two-phase (gas-water), two-dimensional models for a single vertical production well. The two-phase, two-dimensional model allows for a single, infinite- or finite-conductivity, vertical fracture extending radially from the wellbore. The natural fracture network (butt and face cleat) of the coal seam has been identified with a porous network and assigned an effective porosity and absolute permeability. A time-dependent source term, based on a first order kinetic model and a Langmuir equilibrium sorption isotherm is used to describe gas desorbing from the coal matrix into the porous network.

32597 **(PB—84-159441) Water infusion - an effective and economical longwall dust control. Report of investigations/1983.** Cervik, J.; Sainato, A.; Baker, E. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1983. 21p. (BM-RI—8838). NTIS, PC A02/MF A01.

Library of Congress catalog card No. 83-600307.

This Bureau of Mines report describes the technology for infusing water into a longwall panel and reports the results of a recent demonstration in the Lower Sunnyside Coalbed that achieved dust reductions averaging 58 pct. Because water infusion increases moisture content of the coalbed, face air velocities in excess of 500 ft/min (2.5 m/s) are possible, further diluting dust levels before dust entrainment occurs. An economic analysis shows a 23-pct reduction in operating costs when coal production is increased by changing from unidirectional mining to bidirectional mining with water infusion.

32598 (PB—84-159508) Laboratory testing of compressed-oxygen self-rescuers for ruggedness and reliability. Report of investigations/1983. Kyriazi, N.; Kovac, J.; Duerr, W.; Shubilla, J. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1983. 24p. (BM-RI—8839). NTIS, PC A02/MF A01.

Library of Congress catalog card No. 83-18972.

The Bureau of Mines subjected three commercial compressed-oxygen self-contained self-rescuers to a series of laboratory treatments designed to simulate various environmental conditions in underground coal mines. The environmental treatments consisted of extremes of temperature and of shock and vibration. The tests were designed to predict the ability of the self-rescuers to withstand those environmental stresses without causing a decrease in wearer protection. A critical concern was internal damage to an apparatus that would cause it to malfunction or seriously degrade its performance without any obvious external signs.

32599 (PB—84-159540) Control of longwall gob gas with cross-measure boreholes: Upper Kittanning Coalbed. Report of investigations/1983. Campoli, A.A.; Cervik, J.; Schatzel, S.J. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1983. 24p. (BM-RI—8841). NTIS, PC A02/MF A01.

Library of Congress catolog card No. 83-600321.

The cross-measure borehole technique is being studied by the Bureau of Mines as an alternative to the use of surface gob boreholes as a means of controlling methane in gobs during longwall mining. Small-diameter holes are drilled from underground locations into strata overlying the mined coalbed. When the roof strata are fractured by the mining operation, a partial vacuum applied to the boreholes draws the methane out of the fractured strata and prevents it from entering the mine ventilation system. Tests in the Upper Kittanning Coalbed showed that 50 pct of the methane produced by the longwall mining operation was captured by the cross-measure boreholes. Borehole inclination and penetration into the gob are two important borehole parameters that affect the performance of the cross-measure borehole system.

32600 (PB—84-164250) Ergonomic principles of colliery control room design and layout. Mason, S.; Simpson, G.C.; Best, C.F. (Institute of Occupational Medicine, Edinburgh (UK)). May 1983. 50p. (TM—82/8D). NTIS, PC E04/MF E04.

This report deals only with hardware design. Although the advent of computer-based systems has emphazised the need for a careful consideration of ergonomic factors, the installation of such systems is extremely costly and the development process lengthy. It is not uncommon, therefore, to find in all industries a transition period where computer-based systems are introduced alongside conventional instrumentation for the control and monitoring of other operations. This report includes, therefore, a number of sections covering the ergonomic principles of conventional control room instrumentation as well as those relating to computer systems. The aim of this report is to provide information specifically for a given area in order to enable ergonomic considerations to be included in the design process without the necessity of involving ergonomists.

32601 (PB—84-166180) Noise control of rubber-tired front-end loaders used in surface mining. Open file report 13 Apr 79-31 May 83. Dixon, N.R.; Thompson, A.R. (Bolt, Beranek and Newman, Inc., Cambridge, MA (USA)). Jun 1983. 54p. NTIS, PC A04/MF A01.

The objectives of this program were to assess and demonstrate retrofit noise control technology for front-end loaders. The treatments had to be practical, cost-effective, and able to be easily installed by mine personnel. Two loaders, a Caterpillar 988 and an International H-400B, were chosen for the program and the noise sources and acoustic paths that contribute to the operator's noise exposure were identified. Retrofit noise control treatments were designed and installed on the loaders, and noise reductions of more than 10 dBA at the operator position were achieved on both machines. The retrofit packages are low cost and have been field tested in two mines for more than 2 yrs. The results of the program were communicated to the mining industry through a series of noise control workshops and a field manual. The workshops were given in nine States across the United States and more than 440 manuals were distributed to attendees. An audiovisual slide presentation was also developed that summarizes the program.

32602 (PB—84-166370) Influence of rock discontinuities on coal mine subsidence. Open file report 29 Sep 80-10 Sep 83. O'Connor, K.M.; O'Rourke, J.E.; Carr, J. (Woodward-Clyde Consultants, Walnut Creek, CA (USA)). 10 Sep 1983. 130p. NTIS, PC A07/MF A01.

This report documents the process of literature review, site selection, instrument installation, data acquisition, and preliminary data reduction performed to evaluate the influence of rock mass discontinuities on coal mine subsidence. A system of surface, subsurface, and mine level instrumentation was installed at the Armco No. 7 Mine in Montcoal, WV, where the overburden ranged from 630 to 1,040 ft thick. Survey monuments, borehole pressure cells, full profile borehole inclinometer-extensometers, mine level extensometers, stressmeters, and tape extensometer convergence stations were installed to monitor displacements and stress changes. Final design of the instrumentation system was based on (1) review of available information, (2) field mapping and analysis of areal photography, (3) drilling, and (4) borehole geophysics. The report contains the complete graphed data of stress and displacements accompanying the longwall mining of a 4,800-ft-long by 480-ft-wide coal panel.

32603 (PB—84-173756) Development and analysis of slurry transport systems in longwall mining of coal. Open file report 30 Sep 81-21 Sep 82. Yegulalp, T.M.; Knight, R.C.; Marchi, N. (Columbia Univ., New York (USA). Trustees). 30 Sep 1982. 128p. NTIS, PC A07/MF A01.

A preliminary systems analysis of coarse-particle coal slurry pipelines as a haulage method for longwall mining systems was performed. Two exhaustive literature surveys on state-of-the-art longwall mining and slurry transport technologies were prepared. Two representative longwall systems were designed, one with conventional haulage and one with slurry haulage. The two systems were then compared on the bases of cost, safety, and reliability. It was concluded that for the case of a two-face longwall mine, a coarse slurry transport system does not have a clear-cut cost advantage over a conventional (conveyor-hoist) system. However, indications were that a cost advantage could occur under different analytical conditions such as (1) a larger scale mine, (2) if intangible benefits were quantified, and (3) if new generation technology rather than currently available technology were applied to the study.

32604 (TCCR—84-003) Evaluation of coal winning technology - an assessment of the National Coal Board's technological developments. Jones, A.D.W.; Quinn, J.J.; Woolley, K.M. (National Coal Board, London (UK). Technical Change Centre). Jan 1984. 93p. National Coal Board, Technical Change Centre, London, England.

This report is the outcome of a study of the state of technology and its application within the NCB, and concentrates on the technology of coal winning at the face line on longwall faces using shearing machines. Productivity is studied in terms of output per machine shift, and the improvement at the coal face resulting from technological developments is compared to that elsewhere below ground. At the face, output improvements are assigned to changes in the dimensions of the coal face worked by the shearer, and to greater labour and management efficiency. Improvements of roof supports, better controlled shearers, and greater available power at the face have helped to increase productivity. The study showed that improvements at the coal face and surface since 1976 have not been matched by improvements elsewhere below ground, but this is a result of the NCB's allocation of its development effort. To reallocate some resources would be one method of improving total productivity. The report describes the technological developments in coal winning, and covers aspects of health and safety, costs, productivity data, and research and development. (6 refs.)

0130 Transport And Handling

REFER ALSO TO CITATION(S) 32552, 32559, 32603, 32622

32605 (ANL/ER-TM—84-1-Vol.2) Freight Network Modeling System. Volume II. Freight Network Equilibrium Model: Version 4.1 User's Guide and Programmer's Guide. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013273.

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This volume contains an explanation of how to use the Freight Network Equilibrium Model, Version 4.1 (FNEM-4.1). It does not, however, contain any explanation of the model's theoretical basis, which is covered in Volume I, or of the use of preprocessor programs to prepare the data files, which is covered in Volume III. The User's Guide (Sec. 3 of this volume) includes thorough descriptions of all necessary input data, as well as an interpretation of the output. A small, but comprehensive, test problem is used to illustrate nearly all features of the model and to provide specific examples of the input/output. The Programmer's Guide (Sec. 4) is intended for use by the systems professional. The overall program logic of FNEM-4.1 is outlined, and for each subroutine the argument list, calling sequence, purpose, and method are summarized. Important variables and arrays are defined, error messages are discussed, and listings of actual job control language are presented.

32606 (ANL/ER-TM—84-1-Vol.5) Freight Network Modeling System. Volume V. Flexible Network Definition Software User's Guide. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 44p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013445.

This volume is a user's guide for the flexible network definition software that allows the user to manipulate the basic data files to design a network suitable for a particular study. The flexible-network software allows the user to automatically define study regions of any size (county to multi-state) and to use different levels of transportation network detail within each region. This allows the user to model a completely detailed transportation network in the regions of primary interest while modeling movements to and from these regions on an aggregate network in the surrounding regions, thus reducing computational requirements. Because of this flexibility and the numerous support data bases, the flexible network definition capability makes it easy to set up the Freight Network Equilibrium Model (FNEM) or the Shortest Path Analysis and Display (SPAD) program for a new study. The network data bases include data on the rail, highway, water, and pipelines systems in the United States. FNEM is a predictive model that simulates the decisions of both shippers (buyers and sellers of goods) and carriers (rail, truck, and barge operators) and takes into account the competition for transportation facilities and congestion delays caused by all freight movements. The Model produces as output detailed routings, cost estimates, and delay estimates for all shipments and total traffic levels on all facilities.

32607 (DOE/ET/10598—T1) Simplex coal and biomass gasification process. Phase II-C. Demonstration of Bepex briquetting process properties of commercial Simplex briquettes. Arbo, J.C.; Schon, S.; Schulz, H.W. (Columbia Univ., New York (USA). Fossil Energy Lab.). 31 Mar 1979. Contract AS01-77ET10598. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013689.

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The technical feasibility of adapting the high-speed rotary press to the production of Simplex briquettes was successfully demonstrated. More than 50,000 2" X 2" pillow-shaped briquettes were produced comprising six Simplex formulations of immediate interest to the Phase II-D Simplex Development Program. The operating results confirm that the briquetting operation can be implemented commercially at an economic cost. The commercially produced batches of briquettes were characterized and evaluated by subjecting representative samples to a battery of mechanical tests which had been previously developed to determine the structural integrity and caking propensity of Simplex briquettes in the environment they will encounter in gravitating through the shaft furnace during gasification. The test results are presented and discussed in Part I of this report. Part II documents the formulations and raw materials employed in producing the six batches of briquettes for the semi-continuous, steady-state runs to be conducted in Phase II-D. The entire briquette inventory was shipped to the Fossil Energy Laboratory at Columbia. During the experimental operation of the Bepex rotary press it was observed that the productivity of this machine could be substantially improved if the feed mixture were precompacted to counteract the fluffy nature of the RDF. The Bepex management indicated that an effective precompaction device could be designed and constructed at a cost of $50,000. Given such an improved feed mechanism, it was estimated that the productivity of the rotary press might be increased three to five-fold. 11 figures, 10 tables.

32608 (IS-M—462) Sulfur species leached from pyrite during oxidative desulfurization of coal in alkaline solutions. Stephenson, M.D.; Wheelock, T.D.; Markuszewski, R. (Iowa State Univ. of Science and Technology, Ames (USA)). 1983. Contract W-7405-ENG-82. 4p. (CONF-830807—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012135.

From International conference on coal science; Pittsburgh, PA, USA (15 Aug 1983).

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The results indicate that thiosulfate, sulfite, and sulfate are the principal soluble sulfur species produced when coal-derived pyrite leached with a hot alkaline solution containing dissolved oxygen. The distribution of soluble sulfur species in the leachate was found to depend on leaching temperature, oxygen partial pressure, leachant composition, and time of contact. At lower temperatures and oxygen partial pressures and with a short time of contact between the leaching solution and pyrite, the leachate sulfur species were dominated by thiosulfate. However, the leachate also contained significant amounts of sulfite and sulfate. When the temperature, oxygen partial pressure, or time of contact were increased, the proportions of thiosulfate and sulfite decreased and the proportion of sulfate increased. It was observed also that reacted pyrite particles catalyzed the oxidation of thiosulfate to sulfite and sulfate. Consequently when pyrite was oxidized in a stirred reactor for 1 h at elevated temperature and oxygen partial pressure, most of the dissolved sulfur appeared as sulfate and very little as thiosulfate or sulfite. 10 references, 4 figures, 1 table.

32609 (NCB-YRL—16418) Potential for sulphur reduction by coal preparation of the R.O.M. coal at Prince of Wales Colliery, North Yorkshire Area. (National Coal Board, Rotherham (UK). Yorkshire Regional Lab.). Nov 1983. 7p. National Coal Board, Yorkshire Regional Lab., Rotherham, England.

This report gives the results of an analysis of the float and sink characteristics of the R.O.M. coal from the Prince of Wales Colliery, North Yorkshire. This colliery was chosen because of its high sulphur content coal, as part of a national exercise in connection with the acid rain investigation.

32610 (NCB-YRL—16434) Distribution of pyrite and its liberation by crushing in the washed coal at Kellingley Colliery, North Yorkshire Area. (National Coal Board, Rotherham (UK). Yorkshire Regional Lab.). Nov 1983. 25p. National Coal Board, Yorkshire Regional Lab., Rotherham, England.

As part of an investigation into the occurrence of pyrite and its liberation by crushing, the washed coal products from Kellingley Colliery were subjected to a detailed study of the distribution of pyritic sulphur in the coal both before and after crushing.

32611 (NCB-YRL—16443) Potential for sulphur reduction by coal preparation of the R.O.M. coal at Manton Colliery, South Yorkshire Area. (National Coal Board, Rotherham (UK). Yorkshire Regional Lab.). 1983. 8p. National Coal Board, Yorkshire Regional Lab., Rotherham, England.

This report gives the results of an analysis of the float and sink characteristics of the R.O.M. coal from the Manton Colliery, South Yorkshire. This colliery was chosen because of its high sul-

phur content coal, as part of a national exercise in connection with the acid rain investigation.

32612 **(NP—4750996) Transport and distribution systems for coal. Pt. 1. Summary.** (Danmarks Tekniske Hojskole, Lyngby. Lab. for Energiteknik). May 1983. 32p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750996.

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The Danish energy policy is to substitute oil fuels by coal, at least in larger industrial enterprises. The purpose of this investigation is to plan the future coal consumption, to calculate models for coordinated transportation systems and to establish coal quality requirements and handling equipment siting. The supply model comprehends: supplies, unloading, handling, storage and domestic transportation of coal. Coal quality required,Price loco Danish harbor etc. are considered. Gurnace equipment and corresponding coal comminution, flexibility and demand,And the now-existing infrastructure of coal distribution are analyzed. There is proposed a handling system of four coal qualities, covering any possible demand. For every coal-type there are given technical, economic and environmental data in a catalogue. A random average-size county has been chosen as an example and 9 various system proposals of coal handling and distribution for industrial purposes and district heating systems. Train, truck and ship transport costs have been compared for the assumed four coal-types and storage costs and safety (self-ignition prevention) evaluated. The simulated model proves usefulness of a control distribution network for coal supplies.

32613 **(NP—4750997) Transport and distribution systems for coal. Pt. 2. Main report.** (Danmarks Tekniske Hojskole, Lyngby. Lab. for Energiteknik). May 1983. 147p. (In Danish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750997.

Portions are illegible in microfiche products; EFP-81.

The Danish energy policy is to substitute oil fuels by coal,At least in larger industrial enterprises. The purpose of this investigation is to plan the future coal consumption,To calculate models for coordinated transportation systems and to establish coal quality requirements and handling equipment siting. The supply model comprehends: supplies,Unloading,Handling,Storage and domestic transportation of coal. Coal quality required,Price loco Danish harbor etc. are considered. Furnace equipment and corresponding coal comminution,Flexibility and demand,And the now-existing infrastructure of coal distribution are analyzed. There is proposed a handling system of four coal qualities,Covering any possible demand. For every coal-type there are given technical,Economic and environmental data in a catalogue. A random average-size county has been chosen as an example and 9 various system proposals of coal handling and distribution for industrial purposes and district heating systems. Train,Truck and ship transport costs have been compared for the assumed four coal-types and storage costs and safety (self-ignition prevention) evaluated. The simulated model proves usefulness of a control distribution network for coal supplies.

32614 **(NP—4750998) Transport and distribution systems for coal. Pt. 3. Catalogue.** (Danmarks Tekniske Hojskole, Lyngby. Lab. for Energiteknik). May 1983. 108p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750998.

EFP-81.

The third volume of system investigation in coal transport problems consists of data sheets for 9 different solutions of combined coal-terminals/transport networks. Prices for presumed coal quantities,Wear-off and maintenance of technical means are evaluated. Socio-economic factors are considered in relation to the present supply situation.

32615 **(PB—84-166172) Noise control techniques for the design of coal preparation plants. Open file report Jun 80-Sep 82.** Rubin, M.N.; Thompson, A.R.; Cleworth, R.K.; Olson, R.F. (Roberts and Shaefer Co., Chicago, IL (USA)). Dec 1982. 136p. NTIS, PC A07/MF A01.

Prepared in cooperation with Bolt Beranek and Newman, Inc., Cambridge, MA.

The purpose of this work was to document the currently available noise control techniques that can be incorporated into new coal preparation plants during the design stage. This was accomplished by reviewing previous experience, conducting an extensive literature search, visiting operating coal preparation plants, and contacting various equipment manufacturers. The treatments addressed include equipment substitution, changes in plant layout, and retrofit treatments for existing equipment.

32616 **(PB—84-171347) Feasibility study of in-mine coal preparation facilities. Open file report 23 Sep 81-30 Sep 82.** (Dames and Moore, Park Ridge, IL (USA)). Oct 1982. 115p. NTIS, PC A06/MF A01.

Prepared in cooperation with Roberts and Schaefer Co., Chicago, IL.

This work examined the feasibility of in-mine coal preparation. The work included a survey of previous investigations and a preliminary analysis of the economic and technical feasibility on a selection of representative sites and degrees of cleaning. The preliminary analysis determined that in-mine preparation systems can be applied using currently available technology. The most likely mines for application will have shaft or slope access and be deeper than 500 feet. The refuse disposal systems technically feasible are (1) pneumatic placement of coarse refuse in room-and-pillar panels or longwall faces, (2) mechanical placement of coarse and fine fractions in room-and-pillar panels, and (3) hydraulic placement of fine fractions in room-and-pillar panels. The economic feasibility is much more dependent on the refuse disposal system than on the preparation system. It is estimated that the capital cost of an in-mine preparation and disposal system would be $6.00 per clean ton and the operating cost would be $1.24 per clean ton for a 1-million-clean-ton-per-year mine.

0140 Combustion

REFER ALSO TO CITATION(S) 32569, 32572, 32573, 32574, 32575, 32576, 32577, 32578, 32582, 32805, 33038, 33929

32617 **(CONF-840801—8) Theory of fine particle formation in coal combustion.** Ahluwalia, R.K.; Im, K.H.; Chuang, C.F. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007524.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

A theoretical model of evolution of submicrometer ash particles in coal combustion has been formulated. The model describes the condensation of mineral matter vapor by solving the population balance equation which includes terms for homogeneous nucleation, heterogeneous nucleation (particle growth rate) and particle agglomeration. The homogeneous nucleation rate is calculated from modified classical nucleation theory, particle growth rate from conducting mass and energy balance on a droplet, and particle agglomeration is considered to be caused by Brownian motion. The condensation calculations are driven by the gas phase equilibrium chemistry of Na-K-S-Cl-Ca-Mg-Fe-Si-H-O-N-C system. As dictated by the equilibrium chemistry of coal combustion, at proper conditions of pressure and temperature, the model treats Na and K to condense out as Na_2SO_4 and K_2SO_4, Ca as CaO, Mg as MgO, Fe as FeO/Fe_2O_3, and Si as SiO_2. The model is partially validated by comparison against available laboratory data on ash nucleation in a laminar flow furnace. The model predicts an inverse relationship between the particle number density and initial concentration of mineral matter vapor. The number-averaged size of the particles, however, is found to be directly proportional to initial vapor concentration. 11 references, 6 figures.

32618 **(CONF-840805—13) Viscosity of synthetic coal ash slags.** Vorres, K.S.; Greenberg, S. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012093.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

A series of 21 synthetic coal ash slags were studied. It was observed that: (1) plots of the logarithm of viscosity versus temperature showed one or two straight line segments, indicating Newto-

nian behavior in the temperature range studied; (2) plots of the logarithm of the reciprocal of viscosity versus reciprocal of absolute temperature also showed one or two straight line segments, indicating one or two mechanisms were operative over the temperature range; (3) for three series, varying in SiO_2 content, those with the greatest SiO_2 content had the highest viscosities; (4) within a series of given SiO_2 content, those members with the highest Al_2O_3 content had the highest viscosity; (5) for slags exhibiting a transition in behavior, the transition temperature could usually be associated with a ternary eutectic temperature in the phase equilibrium diagram for the most closely related ternary system; and (6) many of the slags probably had a solid phase precipitating from the liquid phase during the cooling period before the transition temperature. 6 references, 6 figures, 2 tables.

32619 **(DOE/CS/40037—T17) Pulverized coal firing of aluminum melting furnaces. Final report.** Stewart, D.L. Jr.; Dastolfo, L.E. Jr.; DeYoung, D.H. (Aluminum Co. of America, Alcoa Center, PA. Alcoa Technical Center). Apr 1984. Contract AC07-78CS40037. 277p. NTIS, PC A17/MF A01; GPO Dep. Order Number DE84013093.

Significant progress has been achieved in the development of a desulfurizing coal combustion process by the Aluminum Company of America (Alcoa) in a research program funded by the United States Department of Energy. Conceptually, high sulfur coal is burned with additives in a staged cyclone combustor, such that sufficient sulfur to obviate products of combustion (POC) scrubbing is retained in the slag by-product. Bench scale studies conducted during the program have shown that 70% of the sulfur (2.65% sulfur coal) reports to the slag at equilibrium through a 25% addition of iron ore to the coal. Results obtained correlate with published data for similar slag at higher temperatures. In pilot scale combustion tests, equilibrium levels of coal sulfur were retained by the slag (11 to 14%). Equilibrium sulfur capture was limited by low particulate retention and operating temperature higher than optimal. Cost estimates for implementation of the process are included in this report. 28 references, 39 figures, 58 tables.

32620 **(DOE/FC/10614—T4) Fundamental combustion studies of low-rank coal slurries. Quarterly technical progress report. No. 1, March 1-May 31, 1984.** Germane, G.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 15 Jun 1984. Contract AC18-84FC10614. 42p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013290.

This contract for fundamental combustion studies of low-rank coal slurries was initiated March 1, 1984. Slurries to be studied will be primarily those produced from steam-dried lignite processed by the Grand Forks Project Office. Contract work includes virgin coal and slurry characterization, slurry spray and atomization measurements, detailed mapping of combustion products and pollutants for low-rank coal slurries in a laboratory reactor, and comparison of results with computer model predictions and data obtained under similar conditions from combustion of high-rank coal-water mixtures. 14 references, 15 figures, 2 tables.

32621 **(DOE/PC/40268—T4) Investigation of pyrite as a contributor to slagging in Eastern Bituminous coals. Quarterly progress report 10, January 1-March 30, 1984.** Bryers, R.W. (Foster Wheeler Development Corp., Livingston, NJ (USA)). Jun 1984. Contract AC22-81PC40268. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013203.

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The objective of this program is to examine slags formed as a result of firing coals with varying concentration levels, size distribution, and orientation of pyrite with regard to mineral matter in the coal in a laboratory furnace. The program tasks are: (1) selection of eight candidate coals; (2) chemical characterization of the coal samples and identification of the pyrite size, distribution, and orientation with respect to other mineral matter and concentration levels; (3) testing of the candidate coals in a laboratory furnace; (4) chemical and physical characterization of the slag and fly ash samples created by the impurities in the coal sample; (5) influence of coal beneficiation on furnace slagging; and (6) analysis of data and identification of parameters influencing the contribution of pyrite to slagging problems. Results of analysis of two coals, Illinois No. 5 Gallatin County, Illinois and Lower Kittaning Clarion County, Pennsylvania, are presented. Examination of the morphology of furnace slag deposited in the 100 lb/hr combustor, as well as industrial furnace, revealed reocurring crystals of iron of pyrite origin on the surface of the deposit. The cubic, octahedron and cubic/octahedron crystals are similar in size and structure to pyrite crystals occasionally found in coal. To characterize the morphology of pyrites within the coal samples of Illinois No. 5 and Lower Kittaning coals were examined using SEM and EDAX analysis. Results are presented of the types of minerals found. 10 figures, 3 tables.

32622 **(DOE/PC/50254—T7) Investigation of vaporization and devolatilization of coal/water mixtures. Seventh quarterly report, November 1, 1983-January 31, 1984.** Solomon, P.R.; Hamblen, D.G.; Markham, J.R. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). 18 Jun 1984. Contract AC22-82PC50254. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013179.

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The objective of this program is to develop the capabilities to predict the vaporization and devolatilization behavior of coal/water mixtures under conditions appropriate for spray combustion. The program is currently collecting data in an entrained flow coal reactor which has a fixed position, coal/water slurry spray injector and a movable product extractor. This reactor is being used to study the vaporization and pyrolysis of coal/water slurries. FT-IR is used for the analysis of the product gases, tars and chars to determine species evolution kinetics and kinetics of secondary reactions such as steam-char reactions, cracking, soot formation, char gasification, cenosphere formation and particle swelling, and char reactivity. Pyrolysis data for ARC prepared coal/water slurries were collected in the reactor system at furnace temperatures between 900 and 1500°C. The major physical effect of the water when slurry droplets are studied is agglomeration of coal particles to produce large char particles. The agglomeration appears to increase with increasing temperature but can be controlled under some conditions by using a coal which has reduced swelling behavior. There is evidence suggesting that the large agglomerates which have been observed are produced by collisions within the transfer tube through which the droplets enter the furnace. FT-IR techniques are being used to measure particle temperatures during pyrolysis and combustion. Measurements were made of char particle temperatures at several oxygen concentrations in the secondary gas. Measurements were also made to compare particle temperatures with and without water. The primary effect of the water appears to be to disburse the particles better, leading to higher heating rates. 1 reference, 15 figures.

32623 (EPRI-CS—3182-Vol.1, pp 5.1-5.22) **Foster Wheeler's low NO/sub x/ combustion program status and developments.** Vatsky, J. (Foster Wheeler Energy Corp., Livingston, NJ). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Foster Wheeler Energy Corporation has developed, and is continuing to advance the state of the art of, internally staged low NO/sub x/ burners. These produce low emission levels without using overfire air or tertiary air ports. Currently, the standard commercial offering is the Controlled Flow/Split-flame burner which consistently achieves NO/sub x/ levels 60% below turbulent burner emissions in both retrofit and new unit operation. A fuel-staging burner concept, investigated in the mid-70's but not commercialized, is now being evaluated for its potential to enhance the NO/sub x/ performance of the commercial burner. Internally staged burners are advantageous because flame shapes are similar to those of older turbulent burners, thereby allowing high capacity low NO/sub x/ burners to be used. Field experience has now been obtained over the capacity range which has been the historical norm for pulverized coal firing: 35 to 300 million Btu/hr. 13 figures.

32624 (EPRI-CS—3182-Vol.1, pp 6.1-6.14) **Fossil steam generator NO/sub x/ control update.** Barsin, J.A. (Babcock & Wilcox Co., Barberton, OH). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Since the third NO/sub x/ Control Seminar of 1980, additional information has been gathered concerning actual NO/sub x/ emissions from fossil-fuel power plants equipped with B & W Dual Register Burners/Compartmented Windbox furnace systems. These systems use a wide range of both bituminous and subbituminous coals. The field results, from actual units firing coal and oil, have demonstrated NO/sub x/ reduction of up to 60 percent compared to units without NO/sub x/ control. B & W's future low-NO/sub x/ R & D direction is summarized as well as the laboratory work done on the High Nitrogen Liquid Fuel burner (HNLF). Also, the most recent laboratory-facility additions (a new 5 x 10^6 Btu/hr furnace, atomization facility and laboratory ashing furnace) are described. These additions will permit more extensive small-scale work. Retrofit concepts for the pre-NSPS coal-fired units, both cyclone and pulverized coal, are presented. Furthermore, a summary is given of B & W's future low-NO/sub x/ R & D direction for meeting the increasingly restrictive NO/sub x/-emission levels. 5 references, 9 figures.

32625 (EPRI-CS—3182-Vol.1, pp 7.1-7.9) **Status of tangential firing low NO/sub x/ technology.** McCartney, M.S.; Collette, R.J. (Combustion Engineering, Inc., Windsor, CT). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Since 1971, the firing systems that C-E has used to meet NSPS have remained unchanged. Although overfire air (OFA) has been supplied on all C-E units since 1971, it is needed, in most cases, to meet only the 1979 NSPS. Thus, units designed today to meet the current standards have the benefit of eight years of operating experience. To maintain an orderly transition in fuel firing system design, C-E has two major, parallel programs to meet lower NO/sub x/ levels on both new and existing boilers in the 1980's. The first program, which is being developed with the EPA, is the Low NO/sub x/ Concentric Firing System (LNCFS). The second is the PM burner developed by Mitsubishi Heavy Industries (MHI) and licensed by C-E for application in the US and Canada. 6 references, 7 figures.

32626 (EPRI-CS—3182-Vol.1, pp 10.1-10.37) **NO/sub x/ emissions control with the distributed mixing burner. Part I. Field evaluation on an industrial size boiler.** Folsom, B.; Abele, A.; Reese, J.; Vatsky, J. (Energy and Environmental Research Corp., Irvine, CA; Foster Wheeler Corp., Livingston, NJ). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The distributed mixing burner (DMB) is a low NO/sub x/ pulverized coal burner for wall-fired applications. It consists of a circular burner with outboard air ports. Low NO/sub x/ emissions are achieved by injecting a portion of the combustion air through the ports so that the circular burner operates under reducing conditions. An overall oxidizing environment is maintained in the furnace to minimize slagging and corrosion. Field operation of the DMB is being evaluated on a 98 Kg/hr (215,000 lb/hr) four-burner industrial-size boiler. This part presents the results of baseline field tests with the original equipment burners and research furnace tests of a prototype DMB. Field tests of the DMB are in progress. Field operating industrial and utility furnaces have a wide range of thermal environments and utilize burners with a wide range of heat release capacities. Both of these factors can affect burner performance and in particular NO/sub x/ emissions. This part discusses tests of several DMBs in three research furnaces. The tests covered a wide range of burner scales and thermal environments. Implications for applications to field operating equipment cre discussed. 9 references, 12 figures, 6 tables.

32627 (EPRI-CS—3182-Vol.1, pp 11.1-11.25) **Evaluation of tangential fired low NO/sub x/ burner.** Takahashi, Yasuro; Sengoku, Tadamasa; Nakashima, Fumiya; Kaneko, Shozo; Tokuda, Kimishiro. (Mitsubishi Heavy Industries, Ltd., Tokyo, Japan). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Mitsubishi Heavy Industries (MHI) was contracted by the Electric Power Research Institute (EPRI) and the Electric Power Development Corporation (EPDC) to evaluate and to confirm the advanced low-NOx burner technology to minimize NOx emissions from tangential fired pulverized coal boilers in United States. The advanced low-NOx burner technology used, named low-NOx PM burner technology, has been developed by MHI in response to stringent NOx emission regulations in Japan. The four coals selected for the low-NOx PM combustion test provide a wide range in coal properties which are typical of US utility usage. The coals include: (1) low sulfur Eastern bituminous coal; (2) high sulfur Midwestern bituminous coal; (3) high nitrogen, low sulfur Western subbituminous coal; and (4) Texas lignite. From the combustion tests of the low-NOx PM burner using the 4 ton/hour (nominally 12.5 MW) pulverized coal fired test furnace with the US typical four coals, the excellent low NOx performance was proved with stable and good combustion conditions (low unburnt carbon). And, the applicability of the low-NOx PM burner for tangential-fired pulverized coal utility boilers was confirmed. 7 references, 24 figures, 4 tables.

32628 (EPRI-CS—3182-Vol.1, pp 11.26-11.43) **Feasibility study of a low-NO/sub x/ retrofittable firing system with US coals.** Kokkinos, A.; Donais, R.E.; McCartney, M.S.; McElroy, M.W. (Combustion Engineering, Inc., Windsor, CT; Electric Power Research Institute, Palo Alto, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

A feasibility study for application of the PM firing system to new and retrofit tangentially fired utility boilers has been completed. The study has shown that the PM firing system is applicable to existing and new utility boilers. The ease and costs of installation are proportional to the level of NO/sub x/ emissions guarantee required. 1 reference, 8 figures, 2 tables.

32629 (EPRI-CS—3182-Vol.1, pp 12.1-12.25) **Low-NO/sub x/ firing system for tangentially coal-fired utility boilers: preliminary testing.** Kokkinos, A.; Lewis, R.D.; Borio, R.W.; McCartney, M.S.; Ferraro, J.M.; Keele, K.E. (Combustion Engineering, Inc., Windsor, CT; Exxon Research & Engineering Co., Florham Park, NJ; Utah Power & Light Co., Castledale, UT). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

A full scale utility demonstration of Combustion Engineering's Low-NO/sub x/ Concentric Firing System (LNCFS) is currently being conducted at Utah Power & Light's 420 MWe Hunter No. 2 boiler with EPA sponsorship. This paper represents the results of the recently completed baseline and post-modification testing. A preliminary analysis of the results has shown that NO/sub x/ emissions can be reduced from baseline emission levels of 460 to 480 ppM (corr. to 3% O_2) and 360 ppM with overfire air to levels of 240 to 260 ppM with overfire air following the LNCFS modification. Additional testing is planned to further optimize the emissions reduction capabilities of the system and to determine the long term effects of low-NO/sub x/ operation on boiler performance. 13 references, 16 figures, 2 tables.

32630 (EPRI-CS—3182-Vol.1, pp 13.1-13.13) **Economic and engineering analysis of arch-fired furnaces.** Vatsky, J.; Cichanowicz, J.E. (Foster Wheeler Energy Corporation, Livingston, NJ; Electric Power Research Inst., Palo Alto, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The majority of arch-fired steam generators are used to fire difficult to burn fuels such as anthracite and coke. However, there are twelve units in the Wisconsin Electric Power Co. system (WEPCo) which fire bituminous coal. Since these units were all built prior to 1960 and are significantly lower in NO/sub x/ emissions than other units, the Electric Power Research Institute (EPRI) contracted with Foster Wheeler Energy Corp. (FWEC) to evaluate the emissions performance of these units, perform an engineering evaluation of the design, and prepare cost estimates for new 500 MW units designed to achieve minimum NO/sub x/. Emissions data from the WEPCo units was taken by KVB, Inc., under a separate EPRI contract. This evaluation is summarized and the NO/sub x/ predictions and cost estimates are provided. 7 figures.

32631 (EPRI-CS—3182-Vol.1, pp 18.1-18.23) **In-furnace control of NO formation in gas- and oil-fired utility boilers.** Radak, L.J.; Weir, A. Jr.; Morton, B.G.; Mansour, M.N.; Smith, L.L.; Kerho, S.E. (Southern California Edison Co., Rosemead; KVB, Inc., Irvine, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

An advanced combustion process termed In-Furnace Control of NO Formation (ICNF) has been developed and patented by the Southern California Edison Company and investigated in conjunction with KVB, Inc., to assess its effectiveness in reducing NO emission from gas- and oil-fired utility boilers. This novel combustion process provides reductions in NO emissions by controlling the combustion stoichiometry in the different regions within a boiler furnace. The ICNF process is defined by two discrete combustion stages. In the first combustion stage, either natural gas or oil is burned under fuel-rich stoichiometry in order to control both thermal and fuel NO formation. The second combustion stage employs generally natural gas in either a fuel-rich or fuel-lean stoichiometry. In most applications, the fuel supply to the second combustion stage is less than 30 percent of the total fuel supply to the boiler. By properly selecting combustion stoichiometry and fuel type, a significant reduction in NO emissions is achieved. The ICNF combustion process was demonstrated in a 45 MW and 175 MW face-fired utility boilers. In each case, the advanced combustion process provided NO emission levels below those obtained with the use of conventional combustion modification techniques. The percentage reduction in emissions achieved by the ICNF process was found to vary depending upon the boiler design and, more importantly, the NO emission characteristics of the gas and oil fired burners used in a specific boiler. 12 references, 12 figures.

32632 (EPRI-CS—3182-Vol.1, pp 25.1-25.25) **LIMB testing: the use of dry sorbents to reduce sulfur oxide emissions from pulverized-coal flames under low-NO/sub x/ conditions.** Case, P.L.; Heap, M.P.; Payne, R.; Pershing, D.W. (Energy and Environmental Research Corp., Irvine, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The problem of limestone sorbent injection into multistaged burner (LIMB) pulverized-coal flames to reduce sulfur dioxide emissions is discussed. Also described are studies conducted at both pilot and bench scale. Pilot scale tests were conducted in two research furnaces firing at up to 20.5 MW, with a prototype distributed mixing burner. With limestone injection, sulfur dioxide captures of 3C to 40 percent were obtained for Ca/S molar ratios of 2. Test data show that burner design, coal type, and mode of sorbent injection all influence the sulfur capture process. Thermal environment in the combustion has a significant impact on sorbent utilization, depending upon the location of sorbent injection. Under conditions of low NO/sub x/ operation two modes of sulfur capture are possible: capture under fuel-rich and fuel-lean conditions. A series of bench scale studies were carried out to determine the parameters controlling capture in these two modes. Under fuel-lean conditions, the thermal history of the sorbent dictates sulfur capture. Under fuel-rich conditions, sulfur is retained in the coal in the fuel-rich region and regeneration of gaseous sulfur during second-stage burnout is possible. Rich-zone stoichiometry had an impact on sorbent utilization in the bench scale studies; utilization was low under highly staged conditions ($SR_1 < 0.7$). The effect of sorbent and fuel type was investigated. Five sorbents were used: two calcites, one marl, one dolomite, and one hydrated lime. Under all of the conditions investigated, the dolomite had the highest utilization. Three fuels were used: bituminous coal, lignite coal, and propane doped with SO_2. Fuel type has an impact on sulfur capture and was not entirely attributable to thermal effects. 9 references, 13 figures, 2 tables.

32633 **(SAND—84-8628) Simultaneous in situ measurement of the size, temperature and velocity of particles in a combustion environment.** Tichenor, D.A.; Mitchell, R.E.; Hencken, K.R.; Niksa, S. (Sandia National Labs., Livermore, CA (USA)). Jan 1984. Contract AC04-76DP00789. 42p. (CONF-840801—6). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007186.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

An in situ method for measuring simultaneously the size, temperature and velocity of pulverized fuel particles is described. Particle size is obtained by imaging a moving, incandescent particle onto a coded aperture and observing the transmitted light. A specially designed aperture yields a double-pulse signal in response to a passing particle. The ratio of the heights of the two pulses yields a measure of particle size that is independent of temperature, emissivity and refractive index. Particle temperature is obtained simultaneously by measuring the transmitted light in two wavelength bands and applying ratio (two-color) pyrometry to these signals. Velocity is measured from the same signals by transit timing. The system is operated as a single particle counter to generate the joint distribution of particle size, temperature and velocity. Since this method uses optical imaging, it is limited to applications where the particle size range of primary interest is 10 μm or larger, and the number density does not exceed $10^4/cm^3$. In addition to this constraint, the minimum particle size and temperature that can be measured is determined by shot noise in the optical detection process. The system is evaluated in a flow reactor using size-classified pulverized fuel particles. 9 references, 4 figures, 4 tables.

32634 **Coal-water slurry combustion in industrial gas turbines.** Lew, H.G.; Rieke, K.L.; Toof, E.J.L. (Westinghouse Electric, Concordville, PA). *Modern Power Systems;* **4**: No. 5, 33-39(May 1984).

A program aiming to evaluate coal-water mixture (CWM) combustion in a low emission staged rich-lean combustor for gas turbine use is being carried out by Westinghouse Electric funded by the Department of Energy's Morgantown Energy Technology Centre. The feasibility of burning CWM in this way has been demonstrated, and no operational problems have come to light. 4 references, 7 figures, 2 tables.

32635 **Corrosion behavior of materials in coal-combustion systems.** Natesan, K. (Argonne National Lab., IL). *Proceedings - Electrochemical Society;* **81-82**: 1076-1077(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 32538, 32551, 32567, 33040

32636 **(DOE/RA/08469—T1) National coal model: description and documentation. Final report.** (ICF, Inc., Washington, DC (USA)). Oct 1976. Contract AC01-75RA08469. 302p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84008957.

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The National Coal Model (NCM) is designed to forecast coal production, consumption, and prices and to analyze coal-related public policy issues. It generates equilibrium solutions through a linear program formulation which balances the supply and demand for coal at minimum cost. The model has a high degree of resolution with 30 supply regions, 35 demand regions, up to 40 possible coal types and six consuming sectors. The model is capable of making both short-term and long-term annual projections under a variety of policy scenarios because it is data driven. This means that users of the model have the capability of changing such factors as region specifications, assumed inflation rates, or assumed growth rates in electricity sales though modifications in the data base; such factors are not a part of the model's structure. This built-in flexibility and high degree of resolution will allow users to address public policy issues with a great deal of precision because the model can be tailored for the analysis to be done. In addition, the model offers analysts the capability of performing the sensitivity analyses needed to gauge the uncertainty surrounding a forecast.

32637 **(EANSW-ESP—29) Coal in New South Wales.** (Energy Authority of New South Wales, Sydney (Australia)). 1982. 52p. Energy Authority of New South Wales, Sydney, Australia.

A history of the coal industry in New South Wales is given and historical data, up to the year 1980, on production, sales, feedstock and prices are presented. The data are mainly presented in tabular or graphical form.

32638 (EPRI-CS—3182-Vol.1, pp 26.1-26.25) **Economics of SCR post combustion NO/sub x/ control processes.** Damon, J.E.; Scheck, R.W.; Cichanowicz, J.E. (Stearns-Roger Engineering Corp., Denver, CO; Electric Power Research Inst., Palo Alto, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The capital and operating costs of the Selective Catalytic NO/sub x/ Reduction (SCR) process as applied to US coal fired utility boilers have been items of considerable interest and controversy in recent years. Several studies have been issued by various entities which identify the costs of the SCR systems as they apply to US utility boilers. However, due to differences in design criteria, economic premises and scopes of supply, these studies indicate a wide range of costs. Three such studies are reviewed in order to reconcile these cost differences by establishing equivalent scopes of supply, design criteria and economic factors for each report reviewed. The operating and capital costs were then adjusted accordingly. The result is a cost comparison in which the SCR system cost differences as reported in the three studies are identified and explained. Updated capital costs and operating costs both in 1/1/83 dollars are reported in this paper. In addition other factors which could significantly increase these updated costs are reported. 3 references, 3 figures, 8 tables.

32639 **(IEA/CREAS—84/07) Organisation and structure of the Pacific steam coal trade.** Gaskin, M. (IEA Coal Research, London (UK). Economic Assessment Service). Oct 1983. 88p. (EAS-G—4). NTIS, PC $50.00.

The report examines the modern steam coal trade between the Pacific Rim countries; it focuses on institutional structure, the organization and commercial practices of the trade - including contract arrangements - and the functioning of the regional market. Questions of risk and risk handling are discussed, also the nature and degree of competition, including the significance of bilateralism, the formation of price, information flows and the effects of government intervention on market operation. The report concludes with a review of problems and prospects in the Pacific trade and with recommendations for improved market function.

32640 **(NP—4770196) Peatlands as an energy source in Finland.** (Suoseura, Helsinki (Finland)). 1982. 137p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770196.

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Separate entries were made for the individual sections of the report

32641 **Fair market value of federal coal.** Gulley, D.A. (Columbia Univ., New York, NY). *West Virginia Law Review;* **86**: No. 3, 741-771(Spr 1984).

The author discusses the issue of raising public revenues through the sale of leases to mine federally owned coal. Dealing as it does with the government's role as a land lord, this subject raises issues not commonly aired in public finance discussion. The article describes the current public controversy, provides a framework for understanding the value of mineral estates, and discusses the recent history of federal policy. He concludes that the term "fair market value" obscures the fact that the price of energy reserves is at issue. When the government sets a price for its coal reserves, it sets in motion a chain of reactions that help shape the extent to which the public resource is used. 77 references, 3 figures.

0160 Health And Safety

REFER ALSO TO CITATION(S) 32591, 32592, 32692, 34373

32642 **(BMFT-FB-HA—84-007) Improved working conditions by air conditioning of underground pits.** Hauer, K.F.; Bergerhausen, K.; Schlueter, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1984. 36p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751771.

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Within the framework of this research project a central installation for cooling underground mining areas was developed. The system is constituted by one coolant circuit (cold water) extending from the surface through the underground mine air coolers. The required pressure reduction in the coolant circuit is brought about by a Pelton turbine. The capacity gain of the turbine is led to a pressure pump linked mechanically to the former; the pump returns the heated-up coolant to the surface. It is possible to return slightly over 50% (based on efficiency) of the cycling coolant to the surface by combining turbine and pump. The advantages of this method against pressure heat exchanger systems is to be seen both in lower capital expenditure (utilization of standard items) as well as in lower energy expenditure (reuse of water from the coolant circuit).

32643 **(CONF-8403131—1) Toxicologic responses to a complex coal conversion by-product: mammalian cell mutagenicity and dermal carcinogenicity.** Cunningham, M.L.; Haugen, D.A.; Kirchner, F.R.; Reilly, C.A. Jr. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013434.

From EPA symposium on short-term genetic bioassays in the evaluation of complex environmental mixtures; Chapel Hill, NC, USA (27 Mar 1984).

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In the present study, we measured mutagenicity and cytotoxicity in hamster and human cells in vitro and tumorigenicity in mouse skin in vivo. The Chinese hamster ovary cell/hypoxanthine guanine phosphoribosyl transferase (CHO/HGPRT) assay has proven useful in estimating the mutagenic activity of pure compounds but has been used only to a limited extent with complex mixtures. The human teratocarcinoma cell line, designated P_3, used in these studies has recently been adapted for use in mutagenesis assays of individual compounds but has not previously been used to evaluate mutagenesis by complex mixtures. In this report, we compare the responses of the hamster and human cell lines and the

mouse skin to chemical class fractions of a complex organic by-product condensate (tar) of coal gasification. The composition of this complex tar is chemically similar to that of petroleum-derived tars and products of fossil fuel combustion. By testing basic, acidic, and neutral chemical class fractions of the complex tar, we demonstrated that the predominant genotoxic components were present in the neutral fraction as measured both in the CHO/HGPRT and dermal carcinogenicity assays. The human P_3 cells were less sensitive for mutagenesis and cytotoxicity than were the rodent cells. Furthermore, fractionation and bioassay provided evidence for interactive effects that indicate the importance of combining chemical characterization and toxicologic evaluation of complex mixtures. 25 references, 1 figure, 2 tables.

32644 **(PB—84-164367) Active man-cooling: a feasibility study. Final report.** Nicholl, A.G.McK.; Martin, R.; Graveling, R.A. (Institute of Occupational Medicine, Edinburgh (UK)). Dec 1983. 93p. (TM—83/16). NTIS, PC E06/MF E06.

There is a small but increasing number of men in the British mining industry working in thermal conditions at or above those at which some form of remedial action could be considered to be required. Various approaches have been investigated. Individual personal cooling using some form of cooled garment has been employed successfully in a number of industries but has not been investigated for general mining work in climatic conditions appropriate to the moderately hot, humid conditions typical of British mining. Of the other personal cooling systems which have been employed, externally connected water-cooled garments appear to offer the best potential. In order to extend the options available to the industry in combatting the effects of hot working conditions on the workforce, the present project was therefore established to examine the feasibility of using such an approach in mining conditions.

32645 **(PB—84-172303) Performance criteria guideline for three explosion protection methods of electrical equipment rated up to 15,000 volts AC. Open file report 15 Aug 81-1 Dec 82.** Linley, L.J.; Luper, A.B. (National Aeronautics and Space Administration, Las Cruces, NM (USA). White Sands Test Facility). Dec 1982. 64p. NTIS, PC A04/MF A01.

The Bureau of Mines, U.S. Department of the Interior, is reviewing explosion protection methods for use in gassy coal mines. This performance criteria guideline is an evaluation of three explosion protection methods of machines electrically powered with voltages up to 15,000 volts ac. A sufficient amount of basic research has been accomplished to verify that the explosion-proof and pressurized enclosure methods can provide adequate explosion protection with the present state of the art up to 15,000 volts ac. The routine application of the potted enclosure as a stand-alone protection method requires further investigation or development in order to clarify performance criteria and verification-certification requirements. An extensive literature search, a series of high-voltage tests, and a design evaluation of the three explosion protection methods performed at the White Sands Test Facility indicate that the explosion-proof, pressurized, and potted enclosures can all be used to enclose up to 15,000 volts ac, if the performance criteria and verification-certification requirements recommended in this guideline are implemented.

32646 **(PB—84-182765) Methodology development for mine life safety system evaluation. Open file report 1 Jan 80-28 Feb 82.** Nutter, R.S.; Smith, N.S.; Voltz, W.R.; Klinkhachorn, P.; Tuthill, D.F. (West Virginia Univ., Morgantown (USA). Dept. of Electrical Engineering). 6 Jun 1982. 429p. NTIS, PC A19/MF A01.

A methodology was developed for qualitative safety hazard evaluation and quantitative reliability analysis of mine monitoring and control systems. Detailed application of these techniques were made to two commercial monitor-control systems and to a microprocessor-based system. A controlled environmental test was conducted on a set of one of the commercial system's outstations. A software reliability evaluation methodology was also developed and applied.

0170 Legislation And Regulations

32647 **Energy independence through increased utilization of American coal: goal of the 98th Congress.** McClure, J.A. (United States Senate, Washington, DC). *West Virginia Law Review;* **86**: No. 3, 687-703(Spr 1984).

The 98th Congress has considered a number of coal-related bills in an effort to improve the nation's chances of achieving energy independence. Some of the requests for legislation were contradictory, calling for both more and less regulation and more and less competition. An overview of coal-related legislation covers leasing, transportation, research and development, taxes, the environment, exports, and synfuels. Congress must resolve issues in each of these areas if the domestic and international use of coal is to expand. 93 references.

32648 **Federal coal-leasing policy; and the Bisti Badlands Wilderness proposal. Oversight hearings before the Subcommittee on Mining, Forest Management, and Bonneville Power Administration and the Subcommittee on Public Lands and National Parks, House of Representatives, Ninety-Eighth Congress, First Session.** Washington, DC; Government Printing Office (1984). 891p.

Hearings held in Santa Fe, New Mexico and Washington, DC brought testimony from public officals, representatives of mining industries, environmentalists, Indians, and interested citizens and organizations on a proposal to lease public lands in the San Juan Basin for coal mining and a bill (H.R. 1575) designating the Bisti Badlands Wilderness. At issue was the Department of Interior's (DOI's) plan, already in evidence in the Powder River sale, to change the procedure for coal leasing to make these lands more readily available to private industry. Despite New Mexico's economic problems, state officials and concerned citizens generally opposed the type of resource management offered by DOI. There was preference for a slower, phased approach to leasing while transportation, environmental, and other problems are resolved. Additional statements and communications follow the testimony of over 100 witnesses.

02 PETROLEUM

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 32672, 34513, 34514

32649 **(BMFT-FB-T—83-313) Direct detection of hydrocarbons with seismic methods applied to land-data.** Jurczyk, D. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Prakla-Seismos G.m.b.H., Hannover (Germany, F.R.)). Dec 1983. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01., Order Number DE84751421.

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Methods for lithological processing of seismic data have been developed, which make applicable the methods of Real-Amplitude-Processing also for land-data. For high data quality the correction methods allow a reliable compensation of the coupling effects. The programs have been integrated in an existing processing system. Data of different methods and different regions of seismic measurements have been processed.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 32661

32650 **(DOE/BC/10331—13) Displacement of oil by carbon dioxide. Final report.** Orr, F.M. Jr.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Aug 1984. Contract AS19-80BC10331. 273p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84012716.

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Results of a comprehensive research effort to identify, investigate and quantify factors which influence CO_2 flood performance are presented. Results of static equilibrium phase behavior experiments for mixtures of CO_2 with Wasson crude and Wasson oil containing varying amounts of solution gas are reported for three temperatures, 90, 105 and 120°F. Analysis of the resulting phase diagrams suggests a simple correlation for minimum miscibility pressure (MMP) based on the vapor pressure of CO_2, extrapolated if necessary for temperatures above the critical temperature of CO_2. Results of phase behavior experiments with the same oil and CO_2 contaminated with nitrogen are also reported, and a simple procedure for estimating the effects of changes in system temperature or contamination of the CO_2 on MMP is offered. Results of detailed measurements of phase compositions in CO_2-hydrocarbon systems are presented. The theory of the effect of CO_2-crude oil phase behavior on displacements in an ideal porous medium is tested by predicting the performance of slim tube displacements from independently measured phase behavior and fluid property data obtained with the continuous multiple contact experiment. The quantitative agreement between prediction and experiment is good enough to suggest that the essentials of CO_2-crude oil phase behavior can be modeled with a small number of pseudo-components. Modifications to the simulator to model effects of dendritic and trapped saturations are described. Calculated composition paths for both secondary and tertiary displacements indicate that microscopic limitations to mixing, due to heterogeneity of the rock or to the presence of water, adversely affect local displacement efficiency. 126 references, 170 figures, 28 tables.

32651 **(DOE/BETC—83/4) Contracts for field projects and supporting research on enhanced oil recovery and improved drilling technology. Progress review No. 36 for quarter ending September 30, 1983.** Linville, B. (ed.). (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Mar 1984. 72p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84012024.

Progress reports for the quarter ending September 30, 1983, are presented for field projects and supported research for the following: chemical flooding; carbon dioxide injection; thermal/heavy oil; resource assessment technology; extraction technology; environmental and safety; microbial enhanced oil recovery; oil recovery by gravity mining; improved drilling technology; and general supporting research.

32652 **(DOE/ET/12084—T2) Carbon dioxide for the recovery of (residual) crude oil. Final report.** Doscher, T.M.; El Arabi, M.; Gharib, S.; Oyekan, R. (University of Southern California, Los Angeles (USA). Dept. of Petroleum Engineering). Mar 1983. Contract AT03-76ET12084. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013450.

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The original plan of the work was altered with the agreement of the various contract officers from that of emphasis on the use of additives in improving the efficiency of carbon dioxide to a plan for developing a thorough understanding of the mechanism and basic efficiency of carbon dioxide as a recovery agent for residual crude oil. As this program proceeded, the results obtained from the physical model studies were not those anticipated from prior theoretical studies and laboratory experiments which had not been physically scaled. This required that the work be continued to no more than define and establish as unequivocally as possible the actual mechanism by which carbon dioxide might recover some of the reputed hundreds of billions barrels of residual oil in reservoirs in the United States. Only in this way could a proper evaluation of the potential of the process be defined and hopefully, subsequently, improved. The work has now been completed and leads to the conclusion that the recovery of residual oil by carbon dioxide depends on solution of the carbon dioxide in the oil and the displacement of the resulting solution by the continuing gas drive, or, alternately, a substitute water drive. The efficiency of the process will depend on the diffusion of carbon dioxide into the residual oil prior to the breakthrough of the latter and the residual oil phase saturation to the concurrent gas drive. 17 references, 16 figures.

32653 **(FRNC-TH—1461) About unilateral problems degenerated from the theory of two-phase flow in porous medium. Application to G. Chavent's modelling of techniques of secondary exploitation of petroleum deposits.** Gagneux, G. (Besancon Univ., 25 (France)). Apr 1982. 150p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751740.

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This work proposes a theoretical study of two-phase flow in porous medium. The theory is more particularly explained in the case of forced displacments, in a porous medium, of a fluid by another, non-miscible, incompressible, and it can be applied in the case of enhanced recovery by water injection in petroleum deposits ("water flooding"). This modelling introduces, in the most general case, a coupled problem involving a parabolic variational inequation (or quasi-variational), doubly non-linear, degenerated, and a family of elliptic equations, the unilateral constraint coming from the fact a well effect is taken into account. The problem can be described by a group of equations and inequation; the two first parts try to show the existence of a solution of the degenerated problem. The last part leads with the general study of the oil-water unidirectional displacement; the existence of a solution is established.

32654 **(GA-A—17555) Recovery of heavy oil and tar sands using a high-temperature nuclear steam supply.** Quade, R.N.; Rao, R. (GA Technologies, Inc., San Diego, CA (USA)). Apr 1984. Contract AT03-84SF11963. 9p. (CONF-840804—25). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012571.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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In this paper, the application of the HTGR to enhanced oil recovery is explored using a typical California heavy oil field (Midway-Sunset) and a tar sands field (Maverick County, Texas) as two examples. Cost comparisons are made with available alternates, centralized coal, jumbo boilers for heavy oil, and an atmospheric fluidized bed (AFB) for tar sands. 10 references, 7 figures, 5 tables.

32655 **(IFP—31-431) Study on the available fuel during co-current in-situ combustion.** Abbas, R.M.J. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). Sep 1983. 144p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751733.

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The chemical reactions for the thermal recovery of heavy oils are studied. Oxidability of two crude oils is studied by effluent gas analysis: porous samples impregnated with oil are heated in an air flow. Effect of pressure on oxidation is low. For a better simulation of hydrodynamic and thermal phenomena, during the approach of the in-situ combustion front, oxidation is also studied with a previous isothermic displacement by cold water, hot water and steam in a special cell, a satisfactory evaluation of available fuel for co-current combustion is obtained but experiments are long and difficult. The effects of gas flow rate, temperature, time, oil and clay content on oxidation are determined by pyrolysis tests which are faster and more simple. A method of operation is proposed for the determination of the quantity of fuel and air necessary for a given couple oil-rock.

32656 **(NP—4750999) Petroleum and gas reservoir models, EFP 81. Technical status report 1981-05-01 to 1982-02-28.** Pejtersen, V.S.; Wuertz, J.; Bech, N.; Reffstrup, J.; Frandsen, P.E.; Winther, A. (Risoe National Lab., Roskilde (Denmark)). 1982. 174p. (In Danish). NTIS (US Sales Only), MF A01. Order Number DE84750999.

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Computerized simulation of petroleum-gas deposits recovery permits to achieve better recovery yield and processing efficiency. Utilization of hydrocarbons in chalk reservoirs in the Danish part of the North Sea resulted in development of many computerized models available commercially. A project of heat storage in ground water reservoirs is established in collaboration between Risoe National Laboratory and the Dept. of Energy Technology at the Technical University. Computerized models simulate fluid flow and

temperatue in porous media, 2- and 3-dimensional models for black oil are tested. Simulation of Gorm field has given useful experience.

32657 **(STF—28A83008) Effect of stimulation by surfactants on the pressure gradient around an injection well.** Hafskjold, B. (SINTEF, Trondheim (Norway)). Mar 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751029.

A 1-dimensional, radial reservoir flow model has been used to study the effect of stimulation by use of surfactants on the pressure drop around an injection well. The model applies to injection of seawater in the oil zone of a reservoir. The case of incompressible steady-state flow has been considered. The calculations revealed that the pressure drop around the injection well for a particular case is reduced by about 50 percent because of stimulation. The injection well in the model is stimulated by displacing the residual oil around the well into the reservoir. This is achieved by utilizing the capability of surfactants to reduce the interfacial tension between oil and water by a fact of two or four orders of magnitude. 10 drawings, 3 tables.

0204 Processing

REFER ALSO TO CITATION(S) 32684

0206 Health And Safety

REFER ALSO TO CITATION(S) 34482, 34483

32658 **(CONF-8405154—6) Comparative toxicological and chemical properties of fuels developed from coal, shale, or petroleum.** Guerin, M.R.; Griest, W.H.; Ho, C.H.; Smith, L.H.; Epler, J.L.; Witschi, H.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012347.

From American Institute of Chemical Engineers spring national meeting; Anaheim, CA, USA (20 May 1984).

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Diesel fuel-, gasoline-, and heating oil-range materials prepared from coal, shale, and petroleum are found to exhibit similar toxicological properties in studies to date. Benzo(a)pyrene content, the weight distribution of bioactive chemical fractions, bacterial mutagenicity, and skin tumorigenicity are found comparable for several refined products. 15 references, 3 tables.

32659 **(STF—15A82041) Studies of flames from various accidental release geometries. Flame size and radiation measurements.** Hustad,J.; Soenju,O.K. (SINTEF, Trondheim (Norway)). Jun 1983. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751024.

Measurements of flame geometry, thermal radiation flux, flame temperature, total heat transfer rate to bodies submerged in the flame, lift-off heights and blow-out limits are made on large turbulent diffusions flames up to flame heights of 8 m and heat releases of 7.5 MW. Various fuel release nozzle geometries have been used. In particular, circular tubes and rectangular channels with aspect ratios up to 8000 have been tested. Vertical propane and methane flames as well as horizontal propane flames have been investigated. Approximate correlations and scaling laws have been established for flame height and flame diameter as function of the Froude Number. Further, approximate correlations for radiation flux distributions and flame lift-off heights have been obtained. 28 drawings, 17 tables.

0207 Marketing And Economics

32660 **(DOE/EIA—0340-83/2) Petroleum Supply Annual, 1983. Volume 2.** (USDOE Energy Information Administration, Washington, DC). Jun 1984. 418p. NTIS, PC A18/MF A01; 1 - GPO; GPO Dep. Order Number DE84013354.

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An annual compilation by the Energy Information Administration of the monthly petroleum supply, petroleum imports and exports, average stock levels, and other information as provided by the petroleum industry. 28 tables.

32661 **(DOE/FE—0039) Naval Petroleum and Oil Shale Reserves. Annual report of operations, fiscal year 1983.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Office of Naval Petroleum and Oil Shale Reserves). 1983. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013544.

Naval Petroleum Reserve No. 1 (NPR-1) in California and Naval Petroleum Reserve No. 3 (NPR-3) in Wyoming continued to be operated at their maximum efficient rates of production during FY 1983. The Government-owned portion of Naval Petroleum Reserve No. 2 in California continued to be leased to private operators as it has been for over 50 years, with the Government receiving a royalty share of production from the leases. All of the Government's share of crude oil produced at the Petroleum Reserves during FY 1983 was sold to the Department of Defense, while natural gas and natural gas liquids were sold competitively on the open market. FY 1983 revenues from the three Naval Petroleum Reserves totaled over $1.5 billion in general receipts and Windfall Profit Taxes. Program expenditures totaled approximately $220 million. The drilling of new wells continued to be an important factor in maintaining the production of NPR-1 and NPR-3 at maximum efficient rates, and it is expected that the primary drilling phase will be concluded in FY 1984. None of the three Naval Oil Shale Reserves has been developed on a commercial scale, and activities concerning these Reserves now focus on identifying potential problems that might restrict development should economic or strategic conditions make it desirable to tap these oil shale resources. Overall, the Naval Petroleum and Oil Shale Reserves program continues to benefit from excellent management, and effective and economic field operations.

32662 **(PB—84-174036) Assessment of the energy balances and economic consequences of the reduction and elimination of lead in gasoline.** (Concawe, The Hague (Netherlands)). 1983. 45p. (CONCAWE—11/83R). NTIS, PC E04/MF E01.

This report gives details of a study carried out at the request of the EEC Working Group: Evolution of Regulations - Global Approach (ERGA). The study assesses the impact of reducing or eliminating lead in gasoline and considers the ultimate situation, ten to fifteen years after the introduction of unleaded gasoline, when only unleaded gasolines are being manufactured. Computer models of refineries incorporating the latest refining technology are used to predict the optimum octane number for unleaded gasoline which will minimize total energy consumption. The report explores the variation of this optimum as the parameters of the base case are varied. The report also comments on the accompanying changes in gasoline composition and the way this will influence automotive exhaust emissions. (Copyright (c) CONCAWE Den Haag December 1983.)

32663 **Strategic stockpile acquisitions and the current world oil market.** Curlee, T.R. (Oak Ridge National Lab., TN). *Energy Policy;* **12**: No. 2, 216-219(Jun 1984).

Recent legislation requires that the US government increase the Strategic Petroleum Reserve at a rate of 300,000 bbl/day; however, under certain circumstances that rate can be lowered to 220,000 bbl/day. It is speculated that the Administration will opt for the lower rate because of recent trends in the world oil market and in the US economy. This communication argues, however, that a rapid stockpile acquisition rate of at least 300,000 bbl/day is called for. While recent trends in the world oil market change the nature of the vulnerability problem, these trends do not necessarily imply that the long-run oil vulnerability problem is less severe. Further, given that there is a need for larger strategic stocks in the long run, the present depressed market conditions suggest that stocks should be accumulated at a rapid rate while these conditions continue. 10 references.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 32668, 34432, 34433, 34490

32664 (EPRI-CS—3182-Vol.1, pp 31.1-31.26) **Thermal DeNO/sub x/ demonstration project.** Dziegiel, H.T.; Aure, T.B.; Anderson, D.W. (Los Angeles Dept. of Water and Power, CA). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

To gather information for pending regulatory proceedings, the Los Angeles Department of Water and Power undertook in 1978 a demonstration of Exxon Research and Engineering Company's patented Thermal DeNO/sub x/ process. In this process, ammonia is injected into the boiler flue gas where the gas temperature is between 1600° F and 2200° F. The ammonia reacts with the NO/sub x/ to form nitrogen and water. A full-scale Thermal DeNO/sub x/ System was installed on Haynes Generating Station, Unit 4, which is a 235 MWe oil- and gas-fired unit in May 1982. The Thermal DeNO/sub x/ System uses a piping grid located in the flue gas stream just downstream of the secondary superheater to inject a mixture of ammonia vapor/compressed air. The grid is subdivided into six zones with independent ammonia injection controls for each zone. A one-year test program on both fuel oil and gas is planned. Initial testing at full load on fuel oil has shown NO/sub x/ reductions between 40 and 50 percent with ammonia breakthrough less than 65 ppM. 3 references, 14 figures, 3 tables.

32665 **(PB—84-168293) OHMSETT (Oil and Hazardous Materials Simulated Environmental Test Tank) test series 77: Global Oil Recovery Skimmer, Veegarm Skimming Arm, Kebab 600, Wylie Skimmer and the Skim-Pak Cluster. Final report Jan 80-Jun 81.** Borst, M. (Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ (USA)). Mar 1984. 102p. NTIS, PC A06/MF A01.

This report covers the performance testing of five oil spill recovery devices at the Oil and Hazardous Materials Simulated Environmental Test Tank in Leonardo, New Jersey. The GOR Skimmer was tow tested in harbor chops, regular waves, and calm water at tow speeds through 2 knots to determine the effectiveness of modifications made to the device since it was last tested. The performance was consistently lower after the modifications in all conditions. The Hydrovac Veegarm was the most exhaustively tested skimmer in this program.

32666 **(STF—15A83030) Equipment for incinerating oily mass. PFO-project No. 2302.** Aasen, D. (SINTEF, Trondheim (Norway)). May 1983. 52p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751026.

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Oily mass collected from shores during oil spill removal is considered dry burnt in a suitable incinerator. The market was searched in order to find a commercial type of oven suited for modifying into a mobile incinerator for oil pollution control. The search was negative as to commercial types of ovens. However, a smaller test burner of the rotary kiln type,Was found in a Norwegian firm. The kiln was later tryed out on oily mass and a specific solution with combined incineration of mud and mass has been planned for and recommended to the employer. The incinerator will have a capacity of 200 l oily mud or mass per hour. The rotary kiln principle is recommended and tested in similar Canadian projects. Experiences from them are a substantial basis for our recommandations. 15 drawings, 19 photos, 6 tables.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 32663

0220 Transport, Pipelines, And Handling

32667 **(FRNC-TH—1327) Experimental and theoretical study of a two-phase flow in vertical and near-horizontal pipes. Application to petroleum engineering.** Genin, R. (Paris-6 Univ., 75 (France)). Dec 1980. 139p. (In French). NTIS (US Sales Only), PC A06. Order Number DE84750798.

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Very few deposits deliver only oil or natural gas. In the majority of production wells, the two phases are simultaneously blown off, and often water complicates the problem for the flow becomes a three-phase flow. In most cases, the two phases (gas and liquid) are delivered in the same pipe to the terminal. The study presented in this report concerns the pipeline between the FRIGG deposit situated in the North Sea, and, the North-East coast of Scotland. The first part of the paper gives a description of the line and sets the main problems. An experimental study and a theoretical analysis in the upright part of the line are presented in the second part. The experimental study leads to study an annular flow in all the parts of the line. The mean thickness of the liquid film being small, laws having a good physical behaviour when the liquid presence factor tends to zero are formulated; it's an asymptotic two-phase flow model. Some comparisons with other experimental results in steady-state conditions, and with other calculation models are presented and discussed. A fifth part deals briefly with unsteady-state two-phase flow. In conclusion, the configuration of the flow is known, for the tested flow rates in the vertical and near-horizontal parts of the line. The transition to the flow with droplets is well specified for high flow rates. The asymptotic model gives good results for the liquid fraction volume and the pressure drops in the case of FRIGG; its extension to the case of CONOCO allows to think of hopeful possibilities of extrapolation. The linear filling pattern gives a convenient mean for transient flow estimates; the case of the MARLIN line shows it can be applied to other flow patterns with some chances to get favourable results.

32668 **(PB—84-171925) Risks of oil transportation in the Eems-Dollard estuary.** Roorda, F.; Hylkema, H. (Milieukundig Studiecentrum Groningen (Netherlands)). 1978. 38p. (In Dutch). (PUB—3). NTIS, PC E04/MF E01.

32669 **(STF—16A82081) Internal corrosion offshore pipelines. Hydrogen induced cracking.** Husa, E.M. (SINTEF, Trondheim (Norway)). Jul 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751027.

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The report gives an outline of the literature concerning the problem of hydrogen induced cracking and discusses testing methods, specimen preparation and test conditions. The effects of mechanical properties and manufacturing process on the susceptibility to hydrogen induced cracking are discussed, and some of the methods used in order to improve the resistance to hydrogen induced cracking are described. 10 drawings, 3 tables.

0230 Properties

REFER ALSO TO CITATION(S) 32658

32670 **(AD-A—139334/7) Comparison of JFTOT (Jet Fuel Thermal Oxidation Tests) and absorbance methods for determining jet fuel thermal stability. Technical report.** Coleman, J.R.; Gallop, L.D. (Defence Research Establishment, Ottawa, Ontario (Canada)). Dec 1983. 26p. (DREO-TN—83-34). NTIS, PC A03/MF A01.

Abstract in French.

The thermal stabilities of five aviation turbine fuels were examined employing the Jet Fuel Thermal Oxidation Tester (JFTOT) and an optical absorbance method based on the Phillips 5 ml bomb

test. No correlation was observed between the ranking of the fuels by the two methods.

32671 **(BMFT-FB-T—83-321) Analysis of heaviest crude oils and hydropyrolysis products.** Shalhoub A.; Neumann, H.J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1983. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751286.

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The project has three objectives: 1. Development of an analysis method for heaviest crude oils and hydropyrolysis products, 2. Characterization of heaviest crude oils from tar sands, 3. Investigation of hydropyrolysis products. We have developed an analysis method, and we have analysed several samples. The results show the differences between crude oils and distillation residues on the one hand and heaviest oils on the other, and they give an explanation for the unexpected poor results of the hydropyrolysis of the heaviest crude oils: The heaviest oils have high contents of asphaltenes up to 20%, but low contents of petroleum resins. The ratio asphaltenes : resins is high, between 5 and 10. The asphaltenes and the resins have high medium relative particle masses, the asphaltenes > 10.000, the resins up to 2.000. The acid number of the resins is higher than these of the asphaltenes, the basic number is lower. The petroleum resins are free from heavy metals. The maltenes have high contact of hetero compounds up to 25%. In the distillation we have an enrichment of the distillation redisue in asphaltenes and a decrease in petroleum resins.

32672 **(IFP—31-115) Solubility of hydrocarbons in the compressed natural gas. Application to petroleum migration in sedimentary basins.** Nogaret, E. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). May 1983. 237p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84750802.

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Study of migration in gaseous phase is this thesis object. Principal characteristics of petroleum and natural gas origin and migration are recalled in the first chapter; the high-pressure device, used to study the behaviour of mixtures oil-gas under pression of 1-100 MPa and temperature of 20-150°C, is described in the second chapter. Results of gaseous phase composition experiments in the case of light oil and natural gas or methane mixtures are presented. These equilibriums modeling has been based on some simple thermodymanic laws and on experimental results. In a third chapter, the model presented describes, with a reasonable precision, the composition of phases together with heavy hydrocarbon fluid mixtures. In the fourth chapter, gas-condensate pool characteristics are recalled, where petroleum is dissolved in gas; then the thermodynamic model has allowed to evaluate oil-gas mixture behaviour in source-rocks and in reservoirs, in the case of a "theoretical" sedimentary basin. Regions where petroleum migration in gaseous phase is possible can then be located. In the last chapter, Mahakam delta basin is studied. This basin and the petroleum fields are briefly described; behaviour of oil-gas mixture in the source-rocks, together with the composition of the oil having possibly migrated in gaseous phase, are, there also, tentatively evaluated. These theoretical results will be compared to many observations made on those fields.

32673 **(NTNF/B—1840.08733) Fractional distillation of North Sea oil. Final report for NTNF-KS.** Glasoe, Oe.; Steinert, O. (SINTEF, Trondheim (Norway)). Mar 1981. 31p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751023.

This work contains experimental investigations of physical data of crude oil samples from five different North Sea reservoirs. Average boiling point, relative specific weight and the corresponding molecular weight is determined as well as the composition of hydrocarbons in each fraction by chromatographic analysis. Equation systems are developed with the experimental data as base and values for average boiling point, relative specific weight, molecular weight and the characterization factor for each fraction are calculated. These values are evaluated with the aim of generally characterizing North Sea oil. 12 drawings, 24 tables.

0250 Combustion

REFER ALSO TO CITATION(S) 34245

32674 **(ORNL/TM—9196) Chemical characterization and toxicologic evaluation of airborne mixtures. Chemical and physical characterization of diesel fuel smoke.** Jenkins, R.A.; Holmberg, R.W.; Wike, J.S.; Moneyhun, J.H.; Brazell, R.S. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 72p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013112.

Diesel fuel No. 2 (DF2) used in the vehicle engine exhaust smoke system (VEESS) has been chemically and physically characterized. A battery of fractionation procedures was used, including elemental analysis, inductively coupled plasma, uv/visible and infrared spectrometry, high performance liquid chromatography (HPLC), gas chromatography and GC/MS. The best overall characterization was provided, by HPLC, which yielded four major fractions (saturated hydrocarbons, 70 percent; substituted benzenes, 16 percent 2-ring aromatics, 12 percent; and 3-ring aromatics, 2 percent) and one minor fraction (polar aromatics, 0.2 percent). These fractions were further analyzed by GC/MS. No single component accounted for more than about one percent of the DF2. The major effect of aerosolization of the DF2, in a generator designed to simulate the military deployment of VEESS smoke, was partitioning of constituents between the vapor and the liquid particulate phase on the basis of their relative volatility. No significant levels of constituents not found in the unaerosolized DF2 were observed in the liquid phase of the smoke generated from it.

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 34514

32675 **(DOE/METC/SP—204) Western Gas Sands Subprogram.** (USDOE Morgantown Energy Technology Center, WV). Dec 1983. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84003098.

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The Western Gas Sands Subprogram (WGSS) is a multidisciplinary research effort within the US Department of Energy program on Unconventional Gas Recovery. The subprogram, managed by DOE's Morgantown Energy Technology Center, is directed towards the development of tight (very low permeability) lenticular gas sands in the western United States. The purpose of the subprogram is to demonstrate the feasibility of economically producing natural gas from low-permeability reservoirs. The subprogram has two broad goals: (1) to reduce the uncertainty of the reservoir production potential and (2) to improve the extraction technology. With input from the gas industry, universities, and geologic and engineering consulting firms, the WGSS was broadened to include more fundamental research and development. Consequently, for the last five years it has focused on improving diagnostic instrumentation, geophysical and engineering interpretation, and stimulation techniques. Integrated geologic studies of the three priority basins containing tight sands and selected by DOE as research targets have also been pursued as part of this new effort. To date, the following tentative conclusions have evolved: Permeability of the tight gas sands can be as much as three to four orders of magnitude lower than conventional gas deposits. Nineteen western geologic basins and trends containing significant amounts of tight gas have been identified. Gas resources in the priority geologic basins are Piceance Basin, 49 tcf., Uinta Basin, 20 tcf., and Greater Green River Basin, 136 tcf. The presence of natural micro-fractures within the production zone of a reservoir and the effective propped length of hydraulically-induced fractures are the critical parameters for successful development of tight sand resources. 8 figures.

32676 (UCRL—53535) Mechanical properties of multiwell MWX-1 sandstone and siltstone at high pressures. Lin, W. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013333.

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Mechanical properties of siltstone and sandstone samples from two depths in Multiwell N# 1 (MWX-1) in Colorado are reported. The overburden pressure was estimated at 49 MPa for the siltstone cores from 1994-m depth and 59 MPa for the sandstone cores from 2405-m depth, respectively. The measured properties include tensile strength, peak and residual compressive strength, stress-strain relations under triaxial compression to 100 MPa confining pressure, and hydrostatic compressibility to 850 MPa confining pressure. Both rocks are virtually isotropic with respect to these properties. The siltstone is weaker than the sandstone under both tensional and compressive loadings. The sandstone is stiffer than the siltstone under triaxial cylindrical compression. However, the siltstone is stiffer than the sandstone under hydrostatic compression at pressures below 50 MPa. Above 50 MPa the sandstone becomes stiffer than the siltstone. 8 references, 10 figures, 4 tables.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 32656

32677 (SAND—84-7132) Multi-well experiment MWX-3 as-built report. (CER Corp., Las Vegas, NV (USA)). May 1984. Contract AC04-76DP00789. 134p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013921.

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The Multi-Well Experiment, sponsored by the Department of Energy, has two overall objectives: (1) characterize low-permeability lenticular gas sands and (2) develop and evaluate technology for the production of natural gas from them. The third well of the experiment was drilled between June and August 1983 at a site in the Rulison Field, seven miles southwest of Rifle, Colorado. This report represents the as-built data and results from that well. 11 figures, 11 tables.

0305 Health And Safety

REFER ALSO TO CITATION(S) 32659

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 32661, 32681, 33426

32678 (DOE/EIA—0130(84/04)) Natural gas monthly, April 1984. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jun 1984. 146p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. Order Number DE84013536.

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Dry gas production during April 1984 was estimated at 1428 billion cubic feet (Bcf), 13.7% above April 1983 dry gas production. Consumption of natural gas during April 1984 was an estimated 1415 Bcf, 2.1% above the April 1983 level. Compared to the previous March, residential consumption in March 1984 was up 16.4%, commercial consumption was up 13.5%, industrial consumption was up 25.4%, and electric utility consumption was down 1.0%. The volume of working gas in underground storage reservoirs at the end of April 1984 was 21.9% below the April 30, 1983 level. The average wellhead price of natural gas in February 1984 was $2.63 per thousand cubic feet (Mcf). In February 1983, the average was $2.64 per Mcf. In April 1984, the average residential price of natural gas was $5.98 per Mcf. The comparable price in April 1983 was $6.04 per Mcf. The average wellhead price for natural gas purchases projected for May 1984 by selected interstate pipeline companies was $2.72 per Mcf.

32679 (DOE/EIA—0489) Competition and other current issues in the natural gas market. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jun 1984. 115p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. Order Number DE84013669.

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Developments and issues in natural gas markets with an emphasis on the development of competition are analyzed. Additional topics are presented in light of recent natural gas debates and, where possible, potential market effects are discussed. No single issue is analyzed in depth.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 34371

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 32675

32680 (SAND—84-1086C) Application of a new multiple fracturing technique to enhance gas production in Devonian shale. Cuderman, J.F. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-830903—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013213.

From IEEE international conference on computer-aided design; Santa Clara, CA, USA (12 Sep 1983).

A new multiple fracturing technology has been applied in stimulating a Devonian shale gas well. In this new technique, propellants are used to obtain controlled pressurization of the wellbore to produce multiple fractures. The pressurization is controlled by suitable choice of propellants having different burn rates. The pressure risetime is the most important parameter governing fracture behavior. Methods are presented for specifying both the risetime and propellants to achieve it for Devonian shales. The Devonian shale stimulation was conducted in a 1040 m deep well in Meigs Co., Ohio. The experimental installation and hardware used are described together with results which include an increase in production from 190 m^3/day to 623 m^3/day. 7 references, 5 figures, 1 table.

0310 Legislation And Regulation

32681 (DOE/PE—0054-Exec.Summ.) First report required by Section 123 of the Natural Gas Policy Act of 1978. Executive summary. (USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC). Jul 1984. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013785.

Section 123 of the Natural Gas Policy Act of 1978 (NGPA) requires the Department of Energy to submit two reports on the natural gas market to the President and Congress. This is the first report. This report examines the current conditions in the natural gas market and analyzes the future effects of three alternative natural gas policies in terms of prices, supply, demand, competitive conditions, market forces, and market equilibrium. The report concludes that gas prices will not rise significantly or fly up after January 1, 1985, when partial decontrol becomes effective under the NGPA. The report also concludes that current federal regulations have inhibited the gas market from responding efficiently to changing market conditions and that the entire Nation would benefit from comprehensive deregulation legislation in the following ways: (1) economic benefits of $33.6 billion to $48.7 billion as a result of greater efficiency, higher domestic gas production, and lower payments for gas and oil imports; (2) recovery of an additional 27 trillion to 48 trillion cubic feet of domestic low-cost, old gas supplies that would not be produced under the NGPA; (3) lower consumer prices for natural gas - $0.56 per thousand cubic feet lower in 1985 than under the NGPA, and $0.27 to $0.45 per thousand cubic feet lower from 1986 to 1995 than under the NGPA; (4) higher levels of both domestic gas consumption and domestic gas production than under the NGPA; and (5) greater flexibility in the gas market to

adjust to changing circumstances, thereby preventing the recurrence of shortages and surpluses.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 32669

0330 Properties

32682 (PB—84-179191) Liquid-vapor and solid-liquid-vapor phase equilibria in natural gas systems. Annual report 1 Jan 83-1 Jan 84. Kidney, A.J.; Sloan, E.D. (Colorado School of Mines, Golden (USA)). Jan 1984. 44p. NTIS, PC A03/MF A01.

Solid-liquid-vapor phase equilibria were measured for the binary systems carbon dioxide plus methane, carbon dioxide plus ethane, and carbon dioxide plus propane over the temperature region 204 to 216 K. Vapor-liquid phase equilibria were measured for carbon dioxide plus methane at 212 K, carbon dioxide plus ethane at 204, 209, and 212 K, and carbon dioxide plus propane at 216 K.

0340 Combustion

REFER ALSO TO CITATION(S) 33536, 33538, 33932, 33933

32683 (PB—84-159912) Venting requirements for high efficiency gas-fired heating equipment. Final report. DeWerth, D.W.; Connelly, S.M. (American Gas Association Labs., Cleveland, OH). Sep 1983. 179p. NTIS, PC A09/MF A01.

A vent simulation model was developed to calculate the capacity of vent connectors used with high efficiency (condensing) gas appliances. 45 vent capacity tables are presented for vent diameter from 1.5 to 12 inches, vent temperatures of 100 and 200F, appliance inputs from 10,000 to 10,000,000 Btu/hr, vertical heights of 0-100 ft. and horizontal distances of 0-100 ft. These tables can be used by manufacturers to design vent systems for high efficiency appliance designs and by codes and standards authorities to check installations. The tables show vent system pressures required for proper venting and whether condensation will occur within a specific vent system. The report also presents venting guidelines for materials of construction, condensate handling, insulation, and system consideration for use when venting high efficiency appliances.

32684 (PB—84-177708) Refinery heater fiber burner demonstration program. Final report Oct 81-Dec 83. Schreiber, R.J.; Gotterba, J.A.; Kesselring, J.P. (Alzeta Corp., Mountain View, CA (USA)). Dec 1983. 106p. (R—83-701-100). NTIS, PC A06/MF A01.

This report discusses feasibility of using the Pyrocore burner, manufactured by Alzeta Corporation, in gas-fired refinery heaters. This low-NOx, radiant burner can address the needs of those oil refineries that wish to enhance the emissions and thermal performance of their heaters and furnaces.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 32661

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 32654

32685 (DOE/LC/10350—1616) Formation, deposition, and drainage of mist in porous media with application to oil shale retorting. Goren, S.L. (California Univ., Berkeley (USA). Dept. of Chemical Engineering). Jun 1984. Contract AS20-80LC10350. 201p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84009254.

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The research is aimed at developing the technological base for understanding and ultimately modeling the physical processes which control droplet size and droplet deposition within oil shale retorts. Two types of experiments were performed for this study: (1) size distributions of oil mists formed by condensation of oil vapor in an inert carrier gas were measured for a wide range of cooling rates and vapor concentrations thought to be typical of retorting conditions. Most experiments were conducted using a steady state tubular condenser which simulates a typical channel through a packed bed. Some unsteady-state experiments were conducted using an initially cold bed of shale rock and following the size distribution of the mist with time as the thermal front propagated through the bed; (2) capture efficiencies of oil mists in packed beds were measured for a wide range of droplet sizes, and gas velocities thought to be typical of retorting conditions. Both clean beds and beds with simulated liquid loading were used. 50 figures.

32686 (SAND—83-2603) Oil yield losses in non-uniform in situ oil shale retorts. Tyner, C.E. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013483.

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Oil yield losses within an in situ oil shale retort can be categorized as either sweep inefficiencies or local yield losses. It is well established that rubble bed non-uniformities can contribute directly to sweep inefficiencies. However, the high local yield losses observed in recent field tests have suggested that these nonuniformities may also decrease local oil yield through increased oil coking, cracking, and combustion. To distinguish oil yield loss mechanisms caused by non-uniform permeability distributions from those caused by other factors (particle size, grade, or operating conditions), a series of pilot retorting experiments was conducted with permeability contrast as the only experimental variable. In these experiments we observed, as a function of increasing permeability contrast, increasing delays in heating (and thus retorting) within the less-permeable zones. This resulted directly in increased oil combustion and cracking losses (11 to 23% versus 5% for a uniform base condition) due to increased overlap of retorting and combustion fronts. We also observed under these conditions corresponding decreases in thermal efficiency and char utilization. Finally, two-dimensional retort modeling calculations have been completed which agree well with the experimental results and help illuminate the important mechanisms causing increased oil loss. These data, together with analyses from recent field experiments, have demonstrated conclusively that local oil yield losses (not just sweep inefficiencies) can be introduced or worsened solely by permeability contrasts. Conversely, it appears that local yield as well as sweep efficiency may be significantly improved by creating more uniform rubble beds. 18 references, 19 figures, 5 tables.

32687 Simulated in situ retorting of Michigan Antrim oil shale. Bartke, T.C.; Duvall, J.J.; Martel, R.A. *Transactions of the American Nuclear Society;* **30**: 7-8(Win 1978).

The Laramie Energy Technology Center (formerly the Laramie Energy Research Center) has been engaged in oil shale technology research for many years. As part of a continuing in situ research effort, retorting characteristics of mine-run Antrim oil shale and crushed, sieved, Antrim oil shale (-0.127 m, +0.0032 m) have been examined in the 10-ton (9,000-kg) retort (TTR) and the controlled-state retort (CSR), respectively. Antrim shale is a local name for the black Devonian-type shales that underlie much of lower Michigan in deposits that range from about 60 to 110 m thick. The organic material is held in a true shale, illite, and yields oil in the range of 3.3 x 10^{-5} to 4.2 x 10^{-5} cu m/kg. The TTR is a lined steel vessel that is 1.4/sup -m/ id x 3.7 m high. After loading the shale into the retort, combustion is initiated with a methane burner. When a combustion zone at about 800 F is established, air or a combination of air/recycle gas is passed through the retort. Retorting advance rate, heating rate, and maximum temperature depend on oxygen concentration in the input gas and on superficial gas velocity. Product oil is collected in a tank below the retort.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 32671

32688 (AD-A—138575/6) Alternate fuels combustion research. Interim report 19 May 80-20 Feb 83 on phase 2. Gratton, M.; Sampath, P. (Pratt and Whitney Canada, Mississauga, Ontario). Oct 1983. 197p. NTIS, PC A09/MF A01.

This report presents the results of the Can Combustor Test Phase (Phase II) of the Alternate Fuels Combustion Research Program. The effects of variations in fuel properties on the performance characteristics of a small can combustion system were determined. Fifteen different fuels were used, encompassing a wide range of chemical and physical properties. The tests covered current specification, broadened specification and alternate source (shale and tar sands derived) fuels. Combustor rig tests were performed to determine the effects of fuel properties on stability, low temperature light-offs, gaseous emissions, smoke emissions, metal temperatures and radiation heat loads. Attempts were also made to characterize fuel nozzle contamination and carbon formation, but these tests were somewhat inconclusive. Based on test results from can combustor tests, a test plan was formulated for testing PT6 and JT15D reverse-flow annular combustors.

0407 Health And Safety

32689 (PB—84-165794) Electrical installations in oil shale mines. Open file report 21 Sep 81-13 Aug 83. Gillenwater, B.B.; Kline, R.J.; Paas, N. (Foster-Miller, Inc., Waltham, MA (USA)). Aug 1983. 165p. NTIS, PC A08/MF A01.

This report presents recommended guidelines and regulatory changes applicable to electrical installations in underground oil shale mines. These recommendations are based on information gathered from oil shale operators, government agencies, and other knowledgeable sources familiar with existing plans for mining systems and electrical installations, and on present understanding of the problems and hazards associated with oil shale mining. Additional discussions of specific electrical problems related to oil shale mining include ground fault current levels, permissible electric wheel motors, permissible batteries and electric starting systems, intrinsically safe instrumentation, and applicability of existing test standards.

32690 (UCRL—15609) Public health risks from an oil shale industry. Perry, B.W.; Gratt, L.B. (IWG Corp., San Diego, CA (USA)). Apr 1984. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013222.

Public health inhalation risks associated with a hypothetical one million barrels-per-day shale oil industry have been estimated for both individual carcinogens and all air pollutants as modeled by a surrogate. The populations at risk which were considered are the local oil shale region and the entire continental United States. The lifetime cancer risks from As, Cd, Cr, Ni, PAH and radiation are less than 10^{-7} occurrences per person per year. The air pollution surrogate, sulfate as a measure of all air pollution exposure, yields a result of 10^{-5} deaths per person per year with large uncertainties. Based on the sulfate surrogate model, the public mortality estimate associated with the refining of imported high sulfur oil which could be replaced by shale oil is significantly larger than the public mortality estimate associated with oil shale production. The dispersion models, health dose-response models, and key uncertainties are discussed. Public health risks associated with oil shale solid waste leachates are considered. Results of a peer review of the analysis and research needs are also presented. 53 references, 3 figures, 5 tables.

32691 (UCRL—15610) High risk groups in oil shale workforce. Gratt, L.B.; Perry, B.W.; Marine, W.M.; Savitz, D.A. (IWG Corp., San Diego, CA (USA); Colorado Univ., Denver (USA). Dept. of Preventive Medicine and Biometrics). Apr 1984. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013225.

The workforce risks of a hypothetical one million barrels-per-day oil shale industry were estimated. The risks for the different workforce segments were compared and high risk groups were identified. Accidents and injuries were statistically described by rates for fatalities, for accidents with days lost from work, and for accidents with no days lost from work. Workforce diseases analyzed were cancers, silicosis, pneumoconiosis, chronic bronchitis, chronic airway obstruction, and high frequency hearing loss. A comparison of the workforce groups under different risk measures (occurrence, fatality, and life-loss expectancy) was performed. The miners represented the group with the largest fatality and the most serious accident rate, although the estimated rates were below the average industry-wide underground mining experience. Lung disease from inhalation exposure of about the nuisance dust threshold limit value presents a significant risk for future concerns. If future environmental dust exposure is at the 100 $\mu g/m^3$ alpha-quartz level, safety improvements in the mining sector are of prime importance to reduce the oil shale worker's life-loss expectancy. 11 references, 1 figure, 11 tables.

32692 (UCRL—15611) Risk of dust-induced lung disease in oil shale workers. Marine, W.M.; Savitz, D.A.; Gratt, L.B.; Perry, B.W. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012677.

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Risks of non-neoplastic lung diseases for future US oil shale worker dust exposures were estimated. In the absence of an active industry, health effects rates from surrogate industries were utilized. The risk of chronic bronchitis, chronic airway obstruction, and pneumoconiosis was quantified from British coal worker data. The risk of occupational silicosis in oil shale miners was estimated using Peruvian metal mines and Vermont granite worker data. Ten percent SiO_2 composition of the dust in the respirable range from oil shale mining and crushing was used. Risk estimates were calculated at the nuisance dust threshold limit value (TLV) of 5 mg/m^3 and at the current SiO_2 TLV of 100 $\mu g/m^3$. Silicosis was the dominant pulmonary health effect, but at the 5 mg/m^3 dust level, pneumoconiosis, chronic bronchitis, and chronic airway obstruction are also important risks. Designing oil shale facilities to meet the nuisance dust TLV may not provide adequate protection to the future generations of workers involved in oil shale extraction and processing. 32 references, 1 figure, 4 tables.

05 NUCLEAR FUELS

0501 Reserves

REFER ALSO TO CITATION(S) 33454

0502 Exploration

32693 (GJBX—4-84) Calibration and performance of a high-resolution gamma-spectroscopy system. Dechant, G.; Donivan, S. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Jun 1984. Contract AC07-76GJ01664. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012792.

One of the primary analytical techniques for the determination of radionuclides is high-resolution gamma-ray spectroscopy. The system used by the Analytical Chemistry Laboratory of Bendix Field Engineering Corporation (Bendix) in support of the U.S. Department of Energy Grand Junction Area Office consists of four Ge(Li) detectors operated under computer control. Quantifying the nuclides of interest is accomplished by comparing the intensities of gamma-ray photopeaks in the samples with those in certified standards after correcting for self-absorption. The success of this method depends on how well the equipment can be calibrated. This document presents a general description of the calibration techniques used by Bendix for their high-resolution gamma-ray spectroscopy system. Complete descriptions of operating procedures and software documentation are contained in separate manuals. 11 references, 5 figures, 8 tables.

0503 Mining

32694 (INFO—0066(Rev.1)) Radiation protection as part of occupational health and safety in the regulation of uranium mines in Canada. Dory, A.B. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 9 Feb 1982. 11p. (CONF-820295—1-Rev.1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702047.

From Saskatchewan safety council meeting; Saskatoon, Saskatchewan, Canada (9 Feb 1982).

The author establishes that radiation exposure is one of the health hazards of uranium mining and therefore has to be controlled. The jurisdictional framework for this is outlined and the role and functions of the Atomic Energy Control Board are detailed. The author then sets down seven objectives for radiation protection followed by an outline of the Canadian regulatory philosophy including an examination of two possible approaches to regulation of uranium mining and milling, and a sketch of pending new regulations. After setting down what he considers the main concerns of the AECB in mine regulation, the author details the Board's licensing process, compliance activities and relationship with workers. The conclusion includes a call for a more rational approach in considering and therefore dealing with radiation as a workplace hazard.

0504 Feed Processing

REFER ALSO TO CITATION(S) 34358

32695 (RFP-Trans—421) Microwave-heated continuous denitrification apparatus. Matsumura, Ken'ichi; Sato, Hajime. (951 3166). Apr 1984. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 57-34498, 1982. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013911.

A microwave-heated continuous denitrification apparatus for production of uranium oxide, plutonium oxide or a mixture of both by microwave irradiation of a solution of uranyl nitrate, plutonium nitrate or a mixture of both is claimed. It is characterized by components such as a dryer for production of dried uranyl nitrate, plutonium nitrate or a mixture of both, a belt conveyor for transporting the dried uranyl nitrate, plutonium nitrate or mixture of both, a microwave-heated oven for causing a denitrification reaction, and a scraping device for scraping the reaction product from the belt conveyor. The dryer consists of a feed-solution supply pump, a feed-solution reservoir in which the liquid is maintained at constant level with an overflow device, a drum dryer for drying the feed solution, and a scraping device for scraping the dried product.

32696 The accelerator breeder, a viable option for the production of nuclear fuels. Grand, P. (Dept. of Nuclear Energy Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3057-3059(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Despite the growing pains of the US Nuclear Power Industry, the dependence of the United States on nuclear energy for the production of electricity and, possibly, process heat is likely to increase dramatically over the next few decades. This paper dismisses fusion as being entirely too speculative to be practical within that time frame. Presently, between the years 2000 and 2050, fissile materials will be in short supply, whether to fuel existing inefficient LWR's or to provide initial fuel inventories for FBR's. The accelerator breeder could produce the fuel shortfall predicted to occur during the first half of the next century. The accelerator breeder offers the only practical means today of producing, or breeding, large quantities of fissile fuels from fertile materials, albeit at high cost. Studies performed over the last few years at Chalk River Laboratory and at Brookhaven National Laboratory have demonstrated that the accelerator breeder is practical, technically feasible with state-of-the-art technology, and can be made to be economically competitive with any other proposed synthetic means of fissile fuel production. This paper gives the parameters of a nearly optimized accelerator-breeder system, then discusses the developmental needs and the economics and institutional problems which this breeding concept faces.

0505 Enrichment

REFER ALSO TO CITATION(S) 33864

32697 (FRNC-TH—1526) Separation of a multicomponent mixture by gaseous diffusion: modelization of the enrichment in a capillary; application to a pilot cascade. Doneddu, F. (Paris-6 Univ., 75 (France)). Oct 1982. 22p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751583.

Starting from the modelization of gaseous flow in a porous medium (flow in a capillary), we generalize the law of enrichment in an infinite cylindrical capillary, established for an isotropic linear mixture, to a multicomponent mixture. A generalization is given of the notion of separation yields and characteristic pressure classically used for separations of isotropic linear mixtures. We present formulas for diagonalizing the diffusion operator, modelization of a multistage, gaseous diffusion cascade and comparison with the experimental results of a drain cascade (N_2-SF_6-UF_6 mixture).

32698 (INIS-mf—8319) Contribution to the future prospect of uranium laser-isotope separation. Becker, F.S. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 9 Jul 1981. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780311.

The two-frequency multiphoton-dissociation of UF_6 seems promising, using a high-power laser, which is tunable in the 16 μm spectral region due to the frequency shift of the 10 μm CO_2-laser radiation, induced by the stimulated rotational Raman effect of para-hydrogen. In the present experiments the isotope selectivity of the multiphoton-dissociation process is studied in order to contribute to the solution of some questions, as for example the influence of high fluorine concentrations on the optical dissociation of UF_6. (DG).

32699 (K/OA—5672) Results from the study of UF_6 consumption on centrifuge process piping and its influence on gamma ray measurements. Close, D.A.; Cooley, J.N.; Fields, L.W.; Hughes, M.R.; Nolan, T.A.; Pratt, J.C.; Strittmatter, R.B.; Swindle, D.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 3 May 1984. Contract AC05-84OT21400. 10p. (CONF-840531—11). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012801.

From 6. annual symposium on safeguards and nuclear material management; Venice, Italy (14 May 1984).

A gamma ray measurement technique for confirming the absence of highly enriched uranium (HEU) in process gas of gas centrifuge enrichment plants has been developed. This measurement technique is complicated by the presence of uranium deposits on the interior walls of the process pipes. The measurement approach is described, the mechanisms for deposit are discussed, and test results for quantifying the uranium in the deposits are reported. Based on observed US plant operating conditions, the absence of HEU in the process gas can be confirmed with a 5-min gamma ray measurement.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 32765, 33227, 33239, 33789

32700 (HEDL-SA—3056-S) Testing of wet scrap recovery equipment for mixed oxide scrap reprocessing. Demiter, J.A.; Klem, M.J.; Owen, T.J. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1984. Contract AC06-76FF02170. 6p. (CONF-840802—1). NTIS, PC A02/MF A01. Order Number DE84007081.

From International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

The Wet Scrap Recovery (WSR) program was initiated at the Hanford Engineering Development Laboratory (HEDL) by

Westinghouse Hanford Company in Richland, Washington to demonstrate fuel fabrication scrap recovery and reconversion to fuel grade oxide powder using the continuous coprecipitation-calcination (COPRECAL) conversion process. Advancements in process control equipment and instrumentation were also developed and demonstrated.

32701 **(KFK—3619) Determination of the distribution of plutonium concentration in uranium- and plutonium dioxide by X-ray analysis.** Riella, H.G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Dec 1983. 155p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751446.

The diffraction profile measured on a (U, Pu)O_2-preparation consists of an equipment broadening function and the physical profile whose broadening is caused by the limited size of the coherently scattering domains, the lattice distortion and the Pu concentration distribution. The determination of the line broadening influences - size of the coherently scattering domains, lattice distortion and Pu concentration distribution - calls for knowledge of the instrument broadening function. This instrument function including the parameters of the diffractometer used, such as the horizontal or vertical divergence of X-rays, the width of the emission lines, the finite slit width of the detector diaphragm etc., was determined theoretically. The separation decovolution of the equipment function from the diffraction profile obtained in the experiment was performed in the Fourier space. Starting from the domain size function and the lattice distortion function a method has been developed which allows to determine the mean domain size, the lattice expansion distribution within a domain and the distribution of plutonium concentrations.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 32767, 33790, 33832

32702 **(CEA-R—5241) Study of the chemical interactions of actinide cations in solution at macroscopic concentrations.** Maurice, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1983. 201p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84751570.

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The aim of this work was to study the interactions of pentavalent neptunium in dodecane-diluted tributyl phosphate with other metallic cations, especially uranium VI and ruthenium present in reprocessing solutions. Pentavalent neptunium on its own was shown to exist in several forms complexed by water and TBP and also to dimerise. In the complex it forms with uranium VI the interaction via the neptunyl oxygen is considerably enhanced in organic solution. Dibutyl phosphoric acid strengthens the interaction between neptunium and uranium. The Np V-ruthenium interaction reveals the existence of a new cation-cation complex; the process takes place in two successive stage and leads to the formation, reinforced and accelerated by HDBP, of a highly stable complex. These results contribute towards a better knowledge of the behaviour of neptunium in the reprocessing operation.

32703 (INIS-BR—119, pp 132) **Degradation of TBP and diluents in the extraction of actinides in the reprocessing.** Barreta, L.G.; Luz, C.T.L.; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

32704 (INIS-BR—119, pp 136) **Determination of light elements in reprocessing flux by X-ray spectrometry.** Souza, L.A.C. de; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

32705 (INIS-BR—119, pp 136) **Development of analysis method.** Carvalho, L.M. de; Zenaro, R.; Sampaio, E.A.L.; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

32706 **(KFK—3439) Simulation of nuclear fuel reprocessing for safeguards.** Canty, M.J.; Dayem, H.A.; Kern, E.A.; Spannagel, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernmaterialueberwachung). Nov 1983. 50p. (Juel—1865). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751440.

For safeguarding the chemical process area of future reprocessing plants the near-real-time material accountancy (NRTMA) method might be applied. Experimental data are not yet available for testing the capability of the NRTMA method but can be simulated using a digital computer. This report describes the mathematical modeling of the Pu-bearing components of reprocessing plants and presents first results obtained by simulation models.

32707 **(KFK—3637) Distribution of U(IV), U(VI), Pu(III) and nitric acid between 30 vol.% tributyl phosphate in dodecane and aqueous nitrate solutions.** Tachimori, S.; Nakashima, T.; Kolarik, Z.; Schuler, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Nov 1983. 23p. (PWA—68/83). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751501.

The distribution of U(IV), U(VI), Pu(III) and nitrid acid between 30 vol.% TBP in dodecane and aqueous nitrate solutions, also containing hydrazine nitrate, was studied in batch experiments. Distribution ratios of the components were measured as functions of the concentrations of nitric and of uranium(IV), uranyl, plutonium(III) and hydrazine nitrates. Major part of the data was obtained at 25°C and temperature dependences of the distribution ratios of U(IV) and nitric acid were measured at 15 to 55°C.

32708 **(ORNL/TM—8948) Solvent cleanup using base-treated silica gel solid adsorbent.** Tallent, O.K.; Mailen, J.C.; Pannell, K.D. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014096.

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A solvent cleanup method using silica gel columns treated with either sodium hydroxide (NaOH) or lithium hydroxide (LiOH) has been investigated. Its effectiveness compares favorably with that of traditional wash methods. After treatment with NaOH solution, the gels adsorb HNO_3, dibutyl phosphate (DBP), UO_2^{2+}, Pu^{4+}, various metal-ion fission products, and other species from the solvent. Adsorption mechanisms include neutralization, hydrolysis, polymerization, and precipitation, depending on the species adsorbed. Sodium dibutyl phosphate, which partially distributes to the solvent from the gels, can be stripped with water; the stripping coefficient ranges from 280 to 540. Adsorption rates are diffusion controlled such that temperature effects are relatively small. Recycle of the gels is achieved either by an aqueous elution and recycle sequence or by a thermal treatment method, which may be preferable. Potential advantages of this solvent cleanup method are that (1) some operational problems are avoided and (2) the amount of $NaNO_3$ waste generated per metric ton of nuclear fuel reprocessed would be reduced significantly. 19 references, 6 figures, 12 tables.

32709 **(DP-tr—69) Thermodynamics of the extraction of uranium and nitric acid from an aqueous solution with TBP/diluent.** Freitas, R.F.deS. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA); Minas Gerais Univ., Belo Horizonte (Brazil). Escola de Engenharia). 8 Jun 1984. Contract AC09-76SR00001. Translation of thesis presented to the Universidade Federal de Minas Gerais, June 1982. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013362.

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Herein is a study of a thermodynamically consistent method to predict the equilibrium distribution for uranyl nitrate and nitric acid between an aqueous solution and an organic phase composed of 30 vol % tributyl phosphate (TBP) in a hydrocarbon diluent. An experimental work is developed to obtain equilibrium data for the system of uranyl nitrate, nitric acid, water and 30 vol % TBP in n-dodecane at 25°C and 40°C. The experimental equilibrium data obtained by means of a computer are compared with the experimental results.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 32719, 32720

32710 **(DPSPU—83-124-1) Safety analysis report for packages: packaging of fissile and other radioactive materials. Final report.** Chalfant, G.G. (comp.). (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1984. Contract AC09-76SR00001. 389p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84013504.

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The 9965, 9966, 9967, and 9968 packages are designed for surface shipment of fissile and other radioactive materials where a high degree of containment (either single or double) is required. Provisions are made to add shielding material to the packaging as required. The package was physically tested to demonstrate that it meets the criteria specified in USDOE Order No. 5480.1, chapter III, dated 5/1/81, which invokes Title 10, Code of Federal Regulations, Part 71 (10 CFR 71), Packing and Transportation of Radioactive Material, and Title 49, Code of Federal Regulations, Part 100-179, Transportation. By restricting the maximum normal operating pressure of the packages to less than 7 kg/cm² (gauge) (99 to 54 psig), the packages will comply with Type B(U) regulations of the International Atomic Energy Agency (IAEA) in its Regulations for the Safe Transport of Radioactive Materials, Safety Series No. 6, 1973 Revised Edition, and may be used for export and import shipments. These packages have been assessed for transport of up to 14.5 kilograms of uranium, excluding uranium-233, or 4.4 kilograms of plutonium metal, oxides, or scrap having a maximum radioactive decay energy of 30 watts. Specific maximum package contents are given. This quantity and the configuration of uranium or plutonium metal cannot be made critical by any combination of hydrogeneous reflection and moderation regardless of the condition of the package. For a uranium-233 shipment, a separate criticality evaluation for the specific package is required.

32711 **(PNL—4726) Wet storage integrity update.** Bailey, W.J.; Johnson, A.B. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 77p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84014130.

This report includes information from various studies performed under the Wet Storage Task of the Spent Fuel Integrity Project of the Commercial Spent Fuel Management (CSFM) Program at Pacific Northwest Laboratory. An overview of recent developments in the technology of wet storage of spent water reactor fuel is presented. Licensee Event Reports pertaining to spent fuel pools and the associated performance of spent fuel and storage components during wet storage are discussed. The current status of fuel that was examined under the CSFM Program is described. Assessments of the effect of boric acid in spent fuel pool water on the corrosion and stress corrosion cracking of stainless steel and the stress corrosion cracking of stainless steel piping containing stagnant water at spent fuel pools are discussed. A list of pertinent publications is included. 84 references, 21 figures, 11 tables.

32712 **(PNL—5089) Foreign programs for the storage of spent nuclear power plant fuels, high-level waste canisters and transuranic wastes.** Harmon, K.M.; Johnson, A.B. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1984. Contract AC06-76RL01830. 104p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84013515.

The various national programs for developing and applying technology for the interim storage of spent fuel, high-level radioactive waste, and TRU wastes are summarized. Primary emphasis of the report is on dry storage techniques for uranium dioxide fuels, but data are also provided concerning pool storage.

0520 Waste Management

REFER ALSO TO CITATION(S) 32712, 32755, 32756, 32757, 32758, 32759, 32762, 33070, 33805, 33805, 34363, 34364, 34461, 34506, 34520

32713 **(ANL/EES-TM—246) Radioactive waste isolation in salt: peer review of the Office of Nuclear Waste Isolation's plans for repository performance assessment.** Harrison, W. (Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 116p. NTIS, PC E06/MF $6.25; GPO Dep. Order Number DE84013677.

Includes 7 sheets of 24x reduction microfiche.

In the peer review of the preliminary performance assessment plan, suggestions to improve the presentation are given, technical issues are addressed, a page-by-page commentary is included, and recommendations are summarized. In the peer review of the verification and validation plan, the following are addressed: suggestions to improve presentation; key activities that have been overlooked; improving the technical content of the plan; and degree to which code documents support the plan. Comments on other supporting code documents, page-by-page commentary, and summary of recommendations are included.

32714 **(BMI/SRP—5011) Well completion report - J. Friemel No. 1 (PD-9) well, Palo Duro Basin, Texas: unanalyzed data.** (Stone and Webster Engineering Corp., Boston, MA (USA)). May 1984. Contract AC06-76RL01830;AC02-83CH10140. 492p. NTIS, PC E18/MF $14.75; 1; GPO Dep. Order Number DE84012670.

Portions are illegible in microfiche products; Includes 42 sheets of 24x reduction microfiche.

This report describes the drilling and testing of J. Friemel No. 1 well, located in north-central Deaf Smith County, approximately 17 miles north of Hereford, Texas. Drilling and testing were performed by Stone and Webster Engineering Corporation as a part of a nationwide program to identify potential locations for a nuclear waste repository. This report describes the drilling and testing activities actually performed (compared to the Field Test Plan), describes the problems encountered, and provides recommendations for future work. Data gathered during drilling and testing of the well are included as appendices to this report. Rigging up and drilling of the rat and mouse holes began on October 15, 1982. The rig was demobilized on March 18, 1983. These data are preliminary. They have been neither analyzed nor evaluated.

32715 **(BNL—34795) Solidification of radioactive waste in a cement/lime mixture.** Zhou, H.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 7p. (CONF-840307—46). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013127.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The suitability of a cement/lime mixture for use as a solidification agent for different types of wastes was investigated. This work includes studies directed towards determining the wasted/binder compositional field over which successful solidification occurs with various wastes and the measurement of some of the waste from properties relevant to evaluating the potential for the release of radionuclides to the environment. In this study, four types of low-level radioactive wastes were simulated for incorporation into a cement/lime mixture. These were boric acid waste, sodium sulfate wastes, aion exchange resins and incinerator ash. 7 references, 3 figures, 2 tables.

32716 **(BNL—34796) Full-scale leaching study of commercial reactor waste forms.** Kalb, P.D.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 7p. (CONF-840307—44). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013234.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

This paper describes a full-scale leaching experiment which has been conducted at Brookhaven National Laboratory (BNL) to study the release of radionuclides from actual commercial reactor waste forms. While many studies characterizing the leaching behavior of simulated laboratory-scale waste forms have been performed, this program represents one of the first attempts in the United States to quantify activity releases for real, full-scale waste forms. 5 references, 5 figures, 1 table.

32717 **(BNL—34825) Leaching of solidified TRU-contaminated incinerator ash.** Fuhrmann, M.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 5p. (CONF-840614—63). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013128.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

Leach rate and cumulative fractional releases of plutonium were determined for a series of laboratory-scale waste forms containing transuranic (TRU) contaminated incinerator ash. The solidification agents from which these waste forms were produced are commercially available materials for radioactive waste disposal. The leachants simulate groundwaters with chemical compositions that are indiginous to different geological media proposed for repositories. In this study TRU-contaminated ash was incorporated into waste forms fabricated with portland type I cement, urea-formaldehyde, polyester-styrene or Pioneer 221 bitumen. The ash was generated at the dual-chamber incinerator at the Rocky Flats Plant. These waste forms contained between 1.25×10^{-2} and 4.4×10^{-2} Ci (depending on the solidification agent) of mixed TRU isotopes comprised primarily of ^{239}Pu and ^{240}Pu. Five leachant solutions were prepared consisting of: (1) demineralized water, (2) simulated brine, (3) simplified sodium-dominated groundwater (30 meq NaCl/liter), (4) simplified calcium-dominated groundwater (30 meq $CaCl_2$/liter), and (5) simplified bicarbonate-dominated groundwater (30 meq $NaHCO_3$/liter). Cumulative fractional releases were found to vary significantly with different leachants and solidification agents. In all cases waste forms leached in brine gave the lowest leach rates. Urea-formaldehyde had the greatest release of radionuclides while polyester-styrene and portland cement had approximately equivalent fractional releases. Cement cured for 210 days retained radionuclides three times more effectively than cement cured only 30 days.

32718 **(CONF-831047—100) Evaluation of a processing technique for immobilization of low-level waste.** Armstrong, K.M.; Klingler, L.M. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84002832.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

A commercially available joule-heated glass furnace system is currently being evaluated at Mound as a means of processing low-level radioactive waste typically found in light water reactor facilities. This evaluation has been primarily concerned with determining the effectiveness of the processing technique in the areas of volume reduction and immobilization. The first phase of the evaluation consisted of a series of nonradioactive experiments to determine the combustion efficiency of the furnace and chemical durability of the glass for several waste types deemed representative of power plant effluent streams. Upon completion of this work, radioactive spiked experiments were initiated which will provide, when completed, a comprehensive mass balance and establish volatility trends for several predominant radioisotopes. 1 reference.

32719 **(DOE/NE/93030—T1) Social and economic aspects of radioactive waste disposal: considerations for institutional management.** (National Research Council, Washington, DC (USA). Panel on Social and Economic Aspects of Radioactive Waste Management). 1984. Contract AT01-80NE93030. 185p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84013409.

Issues addressed in this book include: magnitude, characteristics, and trends of public concerns over radioactive waste; the issue of public trust and confidence in the institutions responsible for radioactive waste management; effects of the number and location of waste repositories on socioeconomic and institutional burdens associated with nuclear waste management; effects associated with interim storage facilities located at reactors or away from reactors; kinds and relative magnitudes of effects associated with the use of alternative forms of transportation (rail, truck, barge); participation by local citizens in identifying, assessing, and proposing ways to ameliorate social and economic siting effects; and potential options for resolving conflict at federal, state, and local levels over repository siting.

32720 **(DOE/NV/10250—14) Commercial nuclear waste research and development program. Quarterly report, January-March 1984.** Hakl, A.R. (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). Apr 1984. Contract AC08-82NV10250. 48p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012680.

Activities performed during the second quarter of Fiscal Year (FY) 1984 to meet task objectives of the Nevada Nuclear Waste Storage Investigations FY 1984 Project Plan are reported. A Task 2 Contract Deliverable letter report, summarizing the storage history of all fuel assemblies at the E-MAD facility and documenting the FY 1983 activities involving these fuel assemblies, was prepared and issued. Task 12 Fuel Temperature Test operations were completed for months 10, 11, and 12 temperature profiles; and the month 13 operation was initiated and the profile was met. The Task 16 contractual requirement for semi-annual integrity monitoring of all fuel assemblies at E-MAD was completed for the first half of FY 1984. Fuel assembly D34 integrity monitoring (Task 16) and calorimetry (Task 18) were performed. Fuel assembly B43 was characterized by videotape and still photography and contamination swipe sampled and calorimetered to measure decay heat rate. Prior to their shipment to E-MAD, Material Interaction Test (MIT) capsules, which contain a number of metal and rock specimens in three environments, and Thermal Expansion Device (TED) assemblies, which measured actual maximum temperatures of the fuel assemblies while in storage, were installed in fuel assemblies B03, D01, D04, and D06 at the Battelle Columbus Laboratories. Preparations are being concluded for removal of these capsules and assemblies for shipment to the Westinghouse Hanford Engineering and Development Laboratory in Hanford, Washington. Quality Assurance personnel continued preparation of 17 procedures for the DOE/NV Quality Assurance Procedure manual, as authorized under Task 23.

32721 **(DOE/SR—84-SPP) Text of slides prepared 1/20/84 for presentation regarding underrun funds.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 20 Jan 1984. Contract AC09-76SR00001. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013158.

32722 **(DOE/SR/00001—T27) SRP hazardous waste monitor well report.** Roberts, J.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 30 Dec 1983. Contract AC09-76SR00001. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013160.

This well report for the third quarter of 1983 contains the data required by South Carolina Hazardous Waste Management Regulations for wells located at 200-F and 200-H seepage basins, 300-M settling basin, and Building 709-G.

32723 **(DP-MS—83-126) Remotely replaceable jumpers and embedded wiring for the DWPF.** Heckendorn, F.M. II. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 15p. (CONF-840614—64). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013168.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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The Defense Waste Processing Facility (DWPF) for radioactive waste vitrification at the Savannah River Plant (SRP) is now under construction. Development of specialized electrical/instrument inter-connectors, or jumpers, is now complete. Remote replacement of the associated through-wall wiring using a standard canyon crane has also been demonstrated. 8 figures.

32724 **(DP-MS—84-7) Savannah River Plant low-level waste incinerator demonstration.** Tallman, J.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1984. Contract AC09-76SR00001. 6p. (CONF-840614—62). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013364.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

A two-year demonstration facility was constructed at the Savannah River Plant (SRP) to incinerate suspect contaminated solid and low-level solvent wastes. Since startup in January 1984, 4460 kilograms and 5300 liters of simulated (uncontaminated) solid and solvent waste have been incinerated to establish the technical and operating data base for the facility. Combustion safeguards have been enhanced, process controls and interlocks refined, some materials handling problems identified and operating experience gained as a result of the 6 month cold run-in. Volume reductions of 20:1 for solid and 25:1 for solvent waste have been demonstrated. Stack emissions (NO_2, SO_2, CO, and particulates) were only 0.5% of the South Carolina ambient air quality standards. Radioactive waste processing is scheduled to begin in July 1984. 2 figures, 2 tables.

32725 **(DPST—76-345-Del.Ver.) Treatment faciliy for 200 Area seepage basin waste. Technical data summary.** Horton, J.H.; McKibbin, J.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 23 Jun 1976. Contract AC09-76SR00001. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013165.

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A combination of flocculation followed by ion exchange has been selected as the appropriate treatment for 200 Area waste. A water treatment plant based on this process is described.

32726 **(DPST—79-433) Decontamination of canister and overpack.** Ondrejcin, R.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 10 Jul 1979. Contract AC09-76SR00001. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013175.

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In the solidification of waste in glass, it is assumed that the primary container (Canister) and the secondary container (Overpack) will become radioactively contaminated. Decontamination will therefore be required. For the in-can melting concept the Canister will be stainless steel. For continuous melting, stainless steel is the reference design, but carbon steel is still being considered. In both concepts carbon steel is the reference design for the overpack. There is some question at present whether an overpack will be used. Since decontamination is to be a remote operation, simplicity is an extremely desirable feature. For this reason the method of immersion of the material to be decontaminated with dissolution of the surface, was chosen rather than a more complex system such as electropolishing. Results from tests using HNO_3-HF solution followed by immersing in either oxalic acid or EDTA solution are given. The HNO_3-HF solution dissolved 0.020 to 0.030 in. of glass adhering to the outer steel surface during decontamination. Greater thicknesses of glass will have to be physically removed if it sticks to the metal.

32727 **(INIS-mf—8325) Investigations on kind and quantity of water contained in permian rock salt and its release and migration in the temperature field of deposited radioactive wastes.** Jockwer, N. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 15 Jun 1981. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780316.

The direct influence of heat-generating wastes on natural salt rocks, their side-minerals and their water components was investigated. The equations established in this study led to the conclusion that the gradient of water concentration in the pore spaces is a principal strength influencing the migration mechanism. This gradient - indicating the relation between drilling hole and pore space in mountaineous areas - depends on the decomposition of water due to radiolysis, corrosion and the degree of compactness of the borehole. Since certain environmental conditions (e.g. maximum mountain temperature etc). are not yet cleared up, the author renounced on calculating the amounts of water seeping away into the borehole. (DG).

32728 **(INIS-mf—8975) International co-operation for safe radioactive waste management.** (Nuclear Energy Agency, 75 - Paris (France)). 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702046.

As a specialised inter-governmental body, NEA pursues three main objectives for its radioactive waste management programme: (1) the promotion of studies to improve the data base available in support of national programmes; (2) the support of research and development through coordination of national activities and promotion of international projects; and (3) an improvement in the general level of understanding of waste management issues and options, particularly in the field of waste disposal. The management of radioactive waste from nuclear activities covers several sequences of complex technical operations; however, as the ultimate objective of radioactive waste management is the disposal of the waste, the largest part of the work programme is directed towards the analysis of disposal options. In addition, NEA is active in various other areas of waste management, such as the treatment and conditioning of waste, the decommissioning of nuclear facilities and the institutional aspects of the long term management of radioactive waste.

32729 **(KFK—3612) Mathematical modelling of the corrosion and leaching behaviour of cemented waste forms.** Kienzler, B.; Korthaus, E.; Koester, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Nov 1983. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751491.

Essential processes which may lead to a radionuclide release from a cemented waste form, in addition to diffusion, are dissolution processes, changing of solubilities and effective diffusion constants caused by chemical reactions, as well as forced fluid movement by variation of the pore volume in the hydrated cement paste. The mobilization and the transportation process can be calculated for a homogeneous cemented waste form by means of diffusion equation extended by dissolution and fluid movement terms. By introduction of effective constants the complex structure of the hardened cement paste will be homogenised mathematically. In the case of Cs leaching the effective constants describing the release process is the diffusion constant, whereas for Sr leaching the constants are the maximum solubilities of the Sr-compounds in the pore fluid of the cement and their dissolution kinetics. Release rates computed from the solution of the differential equations are compared with experimental data to evaluate the essential constants. To do this the computer code "DIFMOD" was developed, which computes the concentrations of the interesting substances in a specimen as a function of different parameters of influence. The procedure used is an implicit Crank-Nicolson finite difference formula.

32730 **(LBL—17745) Geochemistry research planning for the underground storage of high-level nuclear waste.** Apps, J.A. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 205p. NTIS, PC A10/MF A01. Order Number DE84013399.

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This report is a preliminary attempt to plan a comprehensive program of geochemistry research aimed at resolving problems connected with the underground storage of high-level nuclear waste. The problems and research needs were identified in a companion report to this one. The research needs were taken as a point of departure and developed into a series of proposed projects with estimated manpowers and durations. The scope of the proposed research is based on consideration of an underground repository as a multiple barrier system. However, the program logic and organization reflect conventional strategies for resolving technological problems. The projects were scheduled and the duration of the program, critical path projects and distribution of manpower determined for both full and minimal programs. The proposed research was then compared with ongoing research within DOE, NRC and elsewhere to identify omissions in current research. Various options were considered for altering the scope of the program, and hence its cost and effectiveness. Finally, recommendations were made for dealing with omissions and uncertainties arising from program implementation. 11 references, 6 figures, 4 tables.

32731 **(NUREG/CR—3489) Assessment of retrieval alternatives for the geologic disposal of nuclear waste. Final report.** Kendorski, F.S.; Hambley, D.F.; Wilkey, P.L. (Engineers International, Inc., Westmont, IL (USA)). May 1984. 660p. NTIS, PC A99/MF A01 - GPO $11.00. Order Number DE84901376.

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Currently, the most feasible alternative for permanent disposal of high-level nuclear waste is storage in deep underground repositories in geologic media. Uncertainties in investigation, design and construction necessitate maintaining the retrieval option until the isolation is proven likely. Investigations were limited to concepts in geologic media (tuff, salt, and basalt) currently being investigated by DOE. Retrieval in most concepts is not a simple reversal of waste emplacement. This study identified several concerns. Technological concerns are associated with remining and monitoring radioactivity in backfilled storage rooms and retrieval of breached canisters. Retrieval systems currently incorporated into DOE designs were found inadequate for handling breached canisters or those bound in the storage holes. Short holes containing single canisters could be overcored, but equipment must be developed to overcore large diameter holes. Safety concerns common to all repository concepts are protection of personnel from heat, traffic congestion, and deterioration of ground support. Concerns on radionuclide release were the radiation and radionuclides which would be released into the air and water present in a storage room if there were a canister breach. The confinement ventilation circuit air-flows provided in the DOE conceptual designs are just adequate for retrieval and are inadequate for retrieval from backfilled rooms.

32732 **(ORNL/TM—8901) Development of quality assurance and performance testing for the Process Experimental Pilot Plant.** Dole, L.R.; McDaniel, E.W.; Robinson, S.M. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013106.

The Process Experimental Pilot Plant (PREPP) is planned for operation by EG and G Idaho, Inc., to demonstrate a full-scale, cement-based, disposal process for transuranic (TRU) wastes. Procedures need to be developed to determine the quality of the waste product during processing and the durability of the final waste form produced in this facility. This report summarizes basic guidelines for the selection of the waste form composition and process conditions that affect product performance. Physical property tests that may be applicable for quality assurance during processing are also described. Approaches to accelerated performance tests needed to predict the performance of the cement-based waste form are identified, and suggestions are made for the development of processing tests to assure the quality of the final waste-host product. 29 references, 3 figures, 3 tables.

32733 **(ORNL/TM—9003) Feasible modifications for the low-level waste treatment plant at Oak Ridge National Laboratory.** Chilton, J.M. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013113.

Aqueous, low-level, radioactive wastes at Oak Ridge National Laboratory (ORNL) contain small amounts of ^{60}Co, ^{90}Sr, ^{137}Cs, and trace amounts of other radionuclides. These wastes are processed by passage through beds of a strong-acid cation exchange resin, and the treated water is then discharged to the environment. Studies show that pretreatment of the waste with a weak-acid cation exchange resin would result in a significant decrease in regeneration reagents and a saving of manpower. This can be accomplished in the present plant by piping changes on the existing columns. The effluent from the cation treatment process contains all of the radionuclides that are present in anionic form. Routinely, this consists only of approximately one-half of the ^{60}Co. Under certain conditions, other anions (such as ^{131}I) could be present. Studies show that these can be removed by use of an anion exchange resin bed at the end of the process. This would require the construction of an additional column, if the head-end treatment described above is also installed. 2 references, 2 figures, 2 tables.

32734 **(ORNL/TM—9014) Design and construction of a French drain for groundwater diversion in solid waste storage area six at the Oak Ridge National Laboratory.** Davis, E.C.; Stansfield, R.G. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013622.

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Engineering modifiations or engineered barriers have been suggested as a possible means of improving the performance of low-level waste disposal sites located in the humid eastern United States. Design and construction of a passive French drain, located in Solid Waste Storage Area No. 6 at the Oak Ridge National Laboratory. The drain was designed to hydrologically isolate a 0.44-ha area that contains a group of 49 low-level waste trenches by separating it from upgradient groundwater recharge areas. The 252-m drain (maximum depth = 9 m) that surrounds the group of trenches on the north and east sides was excavated, lined with filter fabric, backfilled with crushed stone, and covered with a 0.6 m layer of excavated material at an estimated cost of $153,000. Of the 17 days it took to complete the work, about 5 days were spent excavating sidewall slide material that fell into the drain during excavation. Photography of the drain wall revealed the contorted structure of the weathered shale, which was responsible for many of the slides. Monitoring wells placed at intervals on the drain centerline indicate that groundwater is draining from the surrounding Maryville Formation (Conasauga Group); flows at catch basin No. 2 ranged from a base flow of 4 to 7 L/min to a maximum of 35 L/min, recorded on October 13. In response to groundwater flow in the drain, water levels in several monitoring wells adjacent to the drain have dropped by as much as 2.24 m to an elevation only slightly higher than the bottom of the French drain. In addition to the general lowering of the water table in the vicinity of the drain, water levels in three trenches began to subside, indicating that the drain is beginning to have an effect on the water in the trenches as well. Further monitoring of both drain discharge and water levels in monitoring wells across the site is continuing.

32735 **(PB—84-157353) Storage stability of bituminized reactor wastes.** Peltonen, P.; Niemi, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Reaktorilab.). 1983. 87p. NTIS, PC E05/MF E01.

The aim of the research was to study the protection given by bitumen for nuclear waste in conditions of ground water storage during a time equivalent to the half-life of low and medium level radionuclides. The quality changes of bitumen and resin and bitumen mixtures were analyzed by means of standard tests both before and after storage. The proportional distribution of bitumen components underwent a change already in a short-term storage: the number of asphaltenes rose and the resin and asphaltene ratio decreased. This, the rise in stiffness and growing compressibility indicate a slight embrittlement of bitumen. Bitumen repels water but diffusion of water may take place through a damaged bitumen film.

Water penetrating under the films on the resin surface weakens adhesion. The considerable swelling of resins and internal gas formation weaken adhesion and also promote leaching. These phenomena noticeably weaken the effect of the otherwise excellent waterproofing properties of bitumen. To eliminate the risk of leaching the research report recommends that the steel drums be made thicker and that the amount of bitumen be increased depending on the degree of fineness of the resin type in question.

32736 **(PNL-SA—12126) Uranium mill tailings remedial action technology.** Hartley, J.N.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 24p. (CONF-8406142—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013405.

From Hazardous materials management conference; Philadelphia, PA, USA (5 Jun 1984).

The uranium milling process involves the hydrometallurgical extraction of uranium from ores and the resultant generation of large quantities of waste referred to as tailings. Uranium mill tailings have been identified as requiring remediation because they contain residual radioactive material that is not removed in the milling process. Potential radiation exposure can result from direct contact with the tailings, from radon gas emitted by the tailings, and from radioactive contamination of groundwater. As a result, the technology developed under the US Department of Energy (DOE) Uranium Mill Tailings Remedial Action Project (UMTRAP) and the US Nuclear Regulatory Commission (NRC) Uranium Recovery Program have focused on radon control, groundwater contamination and the long-term protection of the containment system. This paper briefly summarizes the UMTRAP and NRC remedial action technology development. 33 references, 9 figures, 5 tables.

32737 **(PNL-SA—12282) Features of a radioactive liquid-fed ceramic melter system.** Holton, L.K. Jr.; Berger, D.N.; Bjorklund, W.J.; Dierks, R.D. (Pacific Northwest Lab., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 29p. (CONF-840614—59). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013266.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

Pacific Northwest Laboratory has remotely installed a Pilot-Scale Radioactive Liquid-Fed Ceramic Melter (RLFCM) System for conversion of high-level liquid wastes to borosilicate glass in shielded manipulator cells located at Hanford, Washington. The Pilot-Scale RLFCM System consists of a RLFCM, canister handling turnable, glass-level detection system and supporting waste preparation, off-gas treatment, and condensate treatment racks. The Pilot-Scale RLFCM System, which incorporates many of the design features planned for production-scale waste vitrification facilities, will be operated with radioactive wastes to test remote equipment features. Special devices were designed and engineered to assist in remote installation operation and maintenance of the equipment system. This paper discusses the remote features of this vitrification system.

32738 **(RHO-BW-SA—311-P) Disruption scenario analysis for a nuclear waste repository in Hanford Site basalts, Washington State.** Davis, J.D.; Runchal, A.K. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Analytic and Computational Research, Inc., Los Angeles, CA (USA)). 1984. Contract AC06-77RL01030. 11p. (CONF-840307—45). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013200.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

An initial application was made of the Delphi method of expert opinion consensus-forming to disruption scenario analysis of a candidate high-level nuclear waste repository at the Hanford Site, Washington State. Expert scientific and engineering opinion was elicited for the purpose of identifying, categorizing, and ranking of site-specific scenarios within the framework of occurrence-probability categories established by the US Nuclear Regulatory Commission and the US Environmental Protection Agency. After refinement by a second Delphi iteration, the disruption scenarios selected to be of most concern will be characterized in detail for use in assessing long-term repository performance under disruption scenario conditions. 3 references, 4 figures, 2 tables.

32739 **(SAND—82-1977) Effective stress principle for partially saturated media.** McTigue, D.F.; Wilson, R.K.; Nunziato, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013630.

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In support of the Nevada Nuclear Waste Storage Investigation (NNWSI) Project, we have undertaken a fundamental study of water migration in partially saturated media. One aspect of that study, on which we report here, has been to use the continuum theory of mixtures to extend the classical notion of effective stress to partially saturated media. Our analysis recovers previously proposed phenomenological representations for the effective stress in terms of the capillary pressure. The theory is illustrated by specializing to the case of linear poroelasticity, for which we calculate the deformation due to the fluid pressure in a static capillary fringe. We then examine the transient consolidation associated with liquid flow induced by an applied surface load. Settlement accompanies this flow as the liquid is redistributed by a nonlinear diffusion process. For material properties characteristic of tuff from the Nevada Test Site, these effects are found to be vanishingly small. 14 references, 7 figures, 1 table.

32740 **(SAND—83-0372) Unit evaluation at Yucca Mountain, Nevada Test Site: summary report and recommendation.** Johnstone, J.K.; Peters, R.R.; Gnirk, P.F. (Sandia National Labs., Albuquerque, NM (USA); RE/SPEC, Inc., Rapid City, SD (USA)). Jun 1984. Contract AC04-76DP00789. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013650.

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Of the four potential repository units, identified at Yucca Mountain, two potential units the welded, devitrified portions of the Bullfrog and Tram Members of the Crater Flat Tuff are below the water table. The welded, devitrified Topopah Spring Member of the Paintbrush Tuff and the nonwelded, zeolitized Tuffaceous Beds of Calico Hills are above the water table. The results of a study of the four potential repository units are to provide a technical basis for selecting a single target repository unit for future test and evaluation. The unit evaluation studies compared the units rather than provided and absolute assessment. The four ranking evaluation criteria used were: radionuclide isolation time; allowable repository gross thermal loading; excavation stability; and relative economics. Considered the most important of the criteria as well as the most difficult, radionuclide isolation times were estimated using the limited existing data. The allowable repository gross thermal loadings determined from near-field calculations, were nearly the same for all four units. The gross thermal loading supported other criteria by providing the heat source for succeeding thermally related evaluation studies. A large number of studies evaluated excavation stability, including near-field mechanical and thermomechanical finite element code calculations studies. A large number of studies evaluated excavation stability, including near-field mechanical and thermomechanical finite element code calculations, rock matrix property evaluation, and rock mass classification. Relative economics, a minor criterion, did not play an explicit role in the final ranking. Based on all of the analyses, the final recommendation was that the Topopah Springs be selected as the target unit, followed, in order, by the Calico Hills, Bullfrog, and Tram.

32741 **(UCRL—53521) Hydrothermal interaction studies of Bullfrog Member tuff core wafers in J-13 water at 150°C: quantitative analyses of aqueous and solid phases.** Knauss, K.G. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014422.

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This paper describes the experimental work conducted to understand the water chemistry in the near-field surrounding a nu-

clear waste repository in the Bullfrog Member of the Crater Flat Tuff, Nev., and to study any changes in the rock itself due to hydrothermal alteration. The work is part of the Nevada Nuclear Waste Storage Investigations (NNWSI) Project to determine the suitability of the volcanic units at Yucca Mountain for storing high-level nuclear wastes. Static hydrothermal experiments with polished core wafers were run for 60 d; all faces of the core wafers were exposed to solution. Quantitative solution analyses indicate that the solution chemistry for both crushed tuff and solid core wafers is in good agreement. Analyses of the solid phases suggest that the extent of reaction, at least over the 60-d period, is relatively minor, even though solution effects were observed. These experiments show that conditions in a repository located in the Bullfrog Member would be relatively benign with respect to waste form and waste package survival. 4 references 10 figures, 4 tables.

32742 **(UCRL—90846) Overview of geochemical modeling needs for nuclear waste management.** Isherwood, D.; Wolery, T. (Lawrence Livermore National Lab., CA (USA)). 25 May 1984. Contract W-7405-ENG-48. 8p. (CONF-8406134—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012807.

From Workshop on fundamental geochemistry needs for nuclear waste isolation; Los Alamos, NM, USA (20 Jun 1984).

Research needs include, but are not limited to: measurement of basic thermodynamic data at elevated temperatures for species identified by modelers as potentially important; evaluation of substances which control or limit precipitation and/or nucleation kinetics; sorption studies specifically designed to provide data needed for modeling. This includes the rate of sorption, desorption, and the characterization of the solid and aqueous phases; site-mixing models and thermodynamic data for secondary minerals that form solid solutions; the development of standard techniques for measuring rate laws for precipitation and dissolution kinetics; and measurement of rate laws describing redox kinetics, dissolution, and precipitation involving aqueous species and solid phases of interest to geochemical modelers.

32743 **(USGS/WRIR—83-4032) Geohydrology of test well USW H-1, Yucca Mountain, Nye County, Nevada.** Rush, F.E.; Thordarson, W.; Pyles, D.G. (Geological Survey, Denver, CO (USA). Water Resources Div.). 1984. Contract AI08-78ET44802. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013680.

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This report contains the results of hydraulic testing, hydrologic monitoring, and geophysical logging of test well USW H-1, one of several wells drilled in the southwestern part of the Nevada Test Site in cooperation with the US Department of Energy for investigations related to the isolation of high-level radioactive wastes. All rocks penetrated by the well to a total depth of 1829 meters were of volcanic origin and of Tertiary age. Hydraulic head in the zone 688 to 741 meters below land surface was 730 meters above sea level and at a depth of 572 meters below land surface. Deeper zones had hydraulic heads of 781 meters above sea level or higher, indicating an upward component of ground-water flow at the site. The most transmissive zone, with an apparent transmissivity of about 150 meters squared per day, is in the Prow Pass Member of the Crater Flat Tuff in the depth range from 572 to 688 meters below land surface. The remainder of the penetrated rocks in the saturated zone, 688 to 1829 meters, has an apparent transmissivity of about 1 meter squared per day. The most transmissive part of the lower depth range is in the Bullfrog Member of the Crater Flat Tuff in the depth interval from 736 to 741 meters. The apparent hydraulic conductivity of the rocks in this lower depth interval from 688 to 1829 meters commonly ranges between 10^{-4} and 10^{-7} meter per day. Water chemistry is typical of tuffaceous rocks of southern Nevada. The water is a sodium bicarbonate type and has an apparent age of 12,000 to 13,000 years before present, as determined by carbon-14 dating.

32744 **Nuclear waste management: issues and progress.** Kittel, J.H. (Argonne National Lab., IL). *Journal of Environmental Sciences;* **27**: No. 2, 34-41(Mar-Apr 1984).

Progress and institutional issues are discussed that surround the management of spent nuclear fuel and the principal types of nuclear waste. Legislation is described that has been enacted to facilitate difficult political decisions on how waste disposal sites are to be selected. Finally, a summary is given of emerging technology for converting valuable nuclear waste byproducts to useful purposes such as food preservation. 60 references.

32745 **Phenolic cation exchange resin material for recovery of cesium and strontium.** Ebra, M.A.; Wallace, R.M. (to US Dept. of Energy). US Patent 4,423,159. 27 Dec 1983. Filed date 5 May 1982. vp.

PAT-APPL-375232.

A phenolic cation exchange resin with a chelating group has been prepared by reacting resorcinol with iminodiacetic acid in the presence of formaldehyde at a molar ratio of about 1:1:6. The material is highly selective for the simultaneous recovery of both cesium and strontium from aqueous alkaline solutions, such as, aqueous alkaline nuclear waste solutions. The organic resins are condensation polymers of resorcinol and formaldehyde with attached chelating groups. The column performance of the resins compares favorably with that of commercially available resins for either cesium or strontium removal. By combining Cs^{+} and Sr^{2+} removal in the same bed, the resins allow significant reduction of the size and complexity of facilities for processing nuclear waste.

32746 **SYNROC C: preparation and phase equilibria.** Ryerson, F.J.; Hoenig, C.L.; Bazan, F. (Lawrence Livermore National Lab., CA). *Proceedings - Electrochemical Society;* **81-82**: 1061-1062(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32747 **High nuclear waste loadings in tailored ceramics waste forms.** Grantham, L.F.; Flintoff, J.F. (Rockwell International, Canoga Park, CA). *Proceedings - Electrochemical Society;* **81-82**: 1063-1064(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32748 **Hexavalent uranium in fluorite structure oxide solid solutions.** Pepin, J.G.; Vance, E.R.; McCarthy, G.J.; Rusin, J.M. (Pennsylvania State Univ., University Park). *Proceedings - Electrochemical Society;* **81-82**: 1065-1066(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32749 **Alkoxide derived vitreous waste forms.** Pope, J.M.; Harrison, D.E. (Westinghouse Research and Development Center, Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 1070-1071(1981). (CONF-811013—Vol.81-82-Absts). Contract AC08-76NV00597.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32750 **Factors affecting the iron oxidation state and foaming in SRP waste glass.** Plodinec, M.J. (E.I. du Pont de Nemours and Co., Aiken, SC). *Proceedings - Electrochemical Society;* **81-82**: 1072-1073(1981). (CONF-811013—Vol.81-82-Absts). Contract AC09-76SR00001.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32751 **High-temperature vaporization of simulated radioactive waste forms.** Gray, W.J. (Pacific Northwest Lab., Richland, WA). *Proceedings - Electrochemical Society;* **81-82**: 1067-1068(1981). (CONF-811013—Vol.81-82-Absts). Contract AC06-76RL01830.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 32729, 32742, 34298, 34323

32752 **(DOE/SR/00001—T24) Technical summary of the A/M Area Groundwater (AMGW) remedial action program.** Steele, J.L. (comp.). (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1984. Contract AC09-76SR00001. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013340.

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Groundwater in the vicinity of M Area has been found to be contaminated with metal degreasing solvents. The solvents originated from surface sources such as the M-Area settling basin, sewer pipeline, solvent storage tank, and the tributary to Tims Branch. The spatial extent of the groundwater contamination has been defined but not completely characterized. A remedial action program for cleaning up the affected groundwater has been proposed. This technical summary contains the basis for and the details of the proposed M-Area groundwater recovery and treatment process.

32753 **(DPST—83-829-Draft) SRP groundwater protection implementation plan. Draft.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Atomic Energy Div.). 1983. Contract AC09-76SR00001. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013156.

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Maintaining the quality of the Savannah River Plant environment and protecting offsite areas from the impact of facility operations were recognized as important goals prior to site startup. Monitoring programs were initiated in the Savannah River and on the site to establish baseline conditions before facility operations began. These programs by plant personnel and other scientific groups have been significantly expanded during the 30 years of operation. Monitoring results cover airborne effluents and surface and subsurface waters. Analyses include both radioactive and nonradioactive species. These programs have established the Savannah River site as one of the most extensively monitored locations in the world. These activities are the foundation of a broad based environmental program which has consistently demonstrated the negligible environmental impact of the site's operations on the general public. In addition to the extensive monitoring program, many advances in effluent treatment technology have been incorporated in plant facilities. There is no immediate threat of any kind to the on- or offsite population.

32754 **(DPST—83-829-Vol.1) Technical summary of groundwater quality protection program at Savannah River Plant. Volume 1. Site geohydrology, and solid and hazardous wastes.** Christensen, E.J.; Gordon, D.E. (eds.). (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1983. Contract AC09-76SR00001. 516p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE84013347.

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The program for protecting the quality of groundwater underlying the Savannah River Plant (SRP) is described in this technical summary report. The report is divided into two volumes. Volume I contains a discussion of the general site geohydrology and of both active and inactive sites used for disposal of solid and hazardous wastes. Volume II includes a discussion of radioactive waste disposal. Most information contained in these two volumes is current as of December 1983. The groundwater quality protection program has several elements which, taken collectively, are designed to achieve three major goals. These goals are to evaluate the impact on groundwater quality as a result of SRP operations, to restore or protect groundwater quality by taking corrective action as necessary, and to ensure disposal of waste materials in accordance with regulatory guidelines.

32755 **(LBL—15050) Field determination of the hydrologic properties and parameters that control the vertical component of groundwater movement.** Javandel, I. (Lawrence Berkeley Lab., CA (USA)). Mar 1983. Contract AC03-76SF00098. 130p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013859.

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The vertical movement of groundwater through geologic formations generally constitutes the shortest pathway for transport of contaminated fluid from polluted aquifers to the accessible environment. If such movement is encouraged by unfavorable conditions such as an upward hydraulic gradient or relatively permeable zones, it could jeopardize the safety of an underground nuclear waste repository. In this report, a description has been attempted of some of the conventional techniques for measurement of the properties and parameters which control the vertical movement and travel time of groundwater. The most important properties and parameters which control the vertical movement and travel time of groundwater are the effective porosity, hydraulic conductivity, and storativity of the geologic media, and the distribution of hydraulic head within the formations around the repository. Given a candidate repository site, a thorough knowledge of the magnitude and variation of these parameters within the adjacent geologic formations is essential in evaluating the safety of the site. Determination of these parameters in aquifers has been a routine task for hydrologists for several decades. In tight formations or scarcely fractured media which have little or no significance from a water supply point of view, conventional methods are not reliable. During recent years when the need for further information has increased, some new techniques have been developed. However, these methods are far from complete and in some cases there is much room for improvement.

32756 **(NUREG/CR—3316) Verification and field comparison of the Sandia Waste-Isolation Flow and Transport Model (SWIFT).** Ward, D.S.; Reeves, M.; Duda, L.E. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 168p. (SAND—83-1154). NTIS, PC A08/MF A01; 1 - GPO $6.50; GPO Dep. Order Number DE84013760.

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The SWIFT Model has been developed and maintained by Sandia National Laboratories. The Nuclear Regulatory Commission has sponsored this work under its high-level nuclear waste program. SWIFT is a fully-coupled, transient, three-dimensional model. It is implemented by a finite-difference code which solves the equations for flow and transport in geologic media and is used to evaluate repository-site performance. This document represents an important part of the quality-assurance records for the code. Here the process simulators for flow, heat and radionuclide transport are examined using two different types of tests. The analytical verifications test SWIFT calculations against analytical solutions, and the field comparisons test SWIFT calculations against field data. Both types of tests yield good agreement between the SWIFT computations and the comparative data. 35 references, 56 figures, 25 tables.

32757 **(NUREG/CR—3378) Verification of the network flow and transport/distributed velocity (NWFT/DVM) computer code.** Duda, L.E. (Sandia National Labs., Albuquerque, NM (USA)). May 1984. Contract AC04-76DP00789. 47p. (SAND—83-1466). NTIS, PC A03/MF A01; 1 - GPO $4.00; GPO Dep. Order Number DE84012304.

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The Network Flow and Transport/Distributed Velocity Method (NWFT/DVM) computer code was developed primarily to fulfill a need for a computationally efficient ground-water flow and contaminant transport capability for use in risk analyses where, quite frequently, large numbers of calculations are required. It is a semi-analytic, quasi-two-dimensional network code that simulates ground-water flow and the transport of dissolved species (radionuclides) in a saturated porous medium. The development of this code was carried out under a program funded by the US Nuclear Regulatory Commission (NRC) to develop a methodology for assessing the risk from disposal of radioactive wastes in deep geologic formations (FIN: A-1192 and A-1266). In support to the methodology development program, the NRC has funded a separate Maintenance of Computer Programs Project (FIN: A-1166) to ensure that the codes developed under A-1192 or A-1266 remain consistent with current operating systems, are as error-free as possible, and have up-to-date documentations for reference by the NRC staff. Part of

this effort would include verification and validation tests to assure that a code correctly performs the operations specified and/or is representing the processes or system for which it is intended. This document contains four verification problems for the NWFT/DVM computer code. Two of these problems are analytical verifications of NWFT/DVM where results are compared to analytical solutions. The other two are code-to-code verifications where results from NWFT/DVM are compared to those of another computer code. In all cases NWFT/DVM showed good agreement with both the analytical solutions and the results from the other code.

32758 (ORNL—6061) Geochemical information for the West Chestnut Ridge Central Waste Disposal Facility for low-level radioactive waste. Seeley, F.G.; Kelmers, A.D. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 226p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84013765.

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Geochemical support activities for the Central Waste Disposal Facility (CWDF) project included characterization of site materials, as well as measurement of radionuclide sorption and desorption isotherms and apparent concentration limit values under site-relevant laboratory test conditions. The radionuclide sorption and solubility information is needed as input data for the pathways analysis calculations to model expected radioactivity releases from emplaced waste to the accessible environment under various release scenarios. Batch contact methodology was used to construct sorption and desorption isotherms for a number of radionuclides likely to be present in waste to be disposed of at the site. The sorption rates for uranium and europium were rapid (> 99.8% of the total radionuclide present was adsorbed in ~ 30 min). With a constant-pH isotherm technique, uranium, strontium, cesium, and curium exhibited maximum Rs values of 4800 to > 30,000 L/kg throughout the pH range 5 to 7. Sorption ratios were generally lower at higher or lower pH levels. Retardation factors for uranium, strontium, and cesium, explored by column chromatographic tests, were consistent with the high sorption ratios measured in batch tests for these radionuclides. The addition of as little as 0.01 M organic reagent capable of forming strong soluble complexes with metals [e.g., ethylenediaminetetraacetic acid (EDTA) or citric acid] was found to reduce the sorption ratio for uranium by as much as two orders of magnitude. Substitution of an actual low-level waste site trench water for groundwater in these tests was found to give a similar reduction in the sorption ratio.

32759 (PNL-SA—12284) Some statistical and sampling needs for detecting spills or migration at commercial low-level radioactive waste disposal sites. Thomas, J.M.; Eberhardt, L.L.; Skalski, J.R.; Simmons, M.A. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 14p. (CONF-8405195—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013248.

From State Radiation Program Directors conference; Des Moines, IA, USA (21 May 1984).

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As part of a larger study funded by the US Nuclear Regulatory Commission we have been investigating field sampling strategies and compositing as a means of detecting spills or migration at commercial low-level radioactive waste disposal sites. The overall project is designed to produce information for developing guidance on implementing 10 CFR part 61. Compositing (pooling samples) for detection is discussed first, followed by our development of a statistical test to allow a decision as to whether any component of a composite exceeds a prescribed maximum acceptable level. The question of optimal field sampling designs and an Apple computer program designed to show the difficulties in constructing efficient field designs and using compositing schemes are considered. 6 references, 3 figures, 3 tables.

0540 Health And Safety

REFER ALSO TO CITATION(S) 32731, 32738, 34462

32760 (INIS-mf—8903, pp 183-185) Evaluation of the radiation field from uranium. Ben-Shachar, B.; German, U.; Weiser, G. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

32761 (PNL-SA—10915) Comparison of radiation protection programs at US power reactors, uranium mills, and low-level waste disposal sites. Hadlock, D.E.; Hooker, C.D.; Munson, L.H. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 5p. (CONF-840512—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013254.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

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The accident at the Three Mile Island nuclear power reactor in March 1979 and subsequent investigations identified serious concerns involving several aspects of radiation protection programs in general. Battelle, Pacific Northwest Laboratories was contracted by the United States Nuclear Regulatory Commission to characterize and evaluate radiation protection programs at power reactors, uranium mills and commercial low-level waste disposal sites in the United States. These evaluations were termed appraisals because they were structured to facilitate an integrated look at the total radiation protection programs, delve into areas for which explicit regulatory requirements did not exist, and emphasize evaluation of capability and performance rather than compliance with regulations. This paper contains some of the results of 48 power reactor appraisals, 10 uranium mill appraisals and 3 commercial low-level waste disposal site appraisals. The appraisal scope and methodology as well as summary findings and conclusions will be discussed. It was observed from this effort that there is a difference in the adequacy of radiation protection programs as compared between the three types of nuclear facilities. It was observed, based on the risks involved, that the program elements at low-level waste disposal sites and power reactors were substantially better than at the uranium mills. 3 references.

32762 (UCRL—90766) Seismic design of low-level nuclear waste repositories and toxic waste management facilities. Chung, D.H.; Bernreuter, D.L. (Lawrence Livermore National Lab., CA (USA)). 8 May 1984. Contract W-7405-ENG-48. 12p. (CONF-840703—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013218.

From 8. world conference on earthquake engineering; San Francisco, CA, USA (21 Jul 1984).

Identification of the elements of typical hazardous waste facilities (HFWs) that are the major contributors to the risk are focussed on as the elements which require additional considerations in the design and construction of low-level nuclear waste management repositories and HWFs. From a recent study of six typical HWFs it was determined that the factors that contribute most to the human and environmental risk fall into four basic categories: geologic and seismological conditions at each HWF; engineered structures at each HWF; environmental conditions at each HWF; and nature of the material being released. In selecting and carrying out the six case studies, three groups of hazardous waste facilities were examined: generator industries which treat or temporarily store their own wastes; generator facilities which dispose of their own hazardous wastes on site; and industries in the waste treatment and disposal business. The case studies have a diversity of geologic setting, nearby settlement patterns, and environments. Two sites are above a regional aquifer, two are near a bay important to regional fishing, one is in rural hills, and one is in a desert, although not isolated from nearby towns and a groundwater/surface-water system. From the results developed in the study, it was concluded that the effect

of seismic activity on hazardous facilities poses a significant risk to the population. Fifteen reasons are given for this conclusion.

0550 Regulations

REFER ALSO TO CITATION(S) 32699, 32706, 32744

32763 (BNL—34804-Draft) Parameters for several plutonium nuclides and ^{252}Cf of safeguards interest. Zucker, M.S.; Holden, N.E. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 42p. (CONF-840531—12-Draft). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013227.

From 6. annual symposium on safeguards and nuclear material management; Venice, Italy (14 May 1984).

Sets of the neutron emission multiplicity distribution gleaned from the literature for plutonium nuclides and ^{252}Cf are considered. A methodology for rendering the different sets comparable is presented and used to convert the sets to a common basis such that the differences can be evaluated objectively and that allows realistic estimate of the uncertainties. This in turn permits development of a canonical consensus set in certain instances. Evaluated data on the average neutron multiplicity, the total half-lives, and the half-lives for spontaneous fission are also given. A careful search of the literature reveals that the data on neutron multiplicity distributions for many nuclides is surprisingly sparse, considering that almost thirty years has elapsed since the original pioneering work, which in some cases, yield the only reported value. 93 references, 26 tables.

32764 (BNL—34806) Absolute calibration technique for spontaneous fission sources. Zucker, M.S.; Karpf, E. (Brookhaven National Lab., Upton, NY (USA); Suffolk County Community Coll., Selden, NY (USA)). 1984. Contract AC02-76CH00016. 21p. (CONF-840531—13). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013232.

From 6. annual symposium on safeguards and nuclear material management; Venice, Italy (14 May 1984).

An absolute calibration technique for a spontaneously fissioning nuclide (which involves no arbitrary parameters) allows unique determination of the detector efficiency for that nuclide, hence of the fission source strength.

32765 (CEA-CONF—7123) Method for the examination of plutonium quantity in plutonium dioxide used in fuel fabrication for fast neutron reactors at the Cadarache fuel fabrication plant. Donato, W. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Oct 1983. 4p. (In French). (CONF-8309243—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751576.

From 4. ESARDA workshop on the fabrication of mixed oxide fuels; Risley, UK (27 Sep 1983).

Accurate determination of the plutonium content in plutonium dioxide requires to take into account hydration, gas adsorption, radioactive decay and weighing errors. Precaution taken in a fuel fabrication plant and results obtained are given.

32766 (INIS-mf—8915) Nuclear Material (Offences) Act 1983. (British Government, London). 9 May 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780325.

The main purpose of this Act is to enable the United Kingdom to ratify the Convention on the Physical Protection of Nuclear Material which opened for signature at Vienne and New York on 3 March 1980. The Act extends throughout the United Kingdom. (NEA).

32767 (LA—9850-M) Electronics manual for the FAST facility delayed neutron interrogator assay system. Van Lyssel, T.R.; Eccleston, G.W. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014133.

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The Fluorinel and Storage (FAST) Facility delayed neutron interrogator (DNI) is a dual-assay instrument used to assay spent fuel for a criticality control check before dissolution and also to measure waste solids for material accountability before disposal. A separate shielded cubicle located below the fluorinel fuel dissolution cell houses the DNI. Two tubes penetrate the dissolution cell floor and extend down through the instrument. The smaller tube enables precision assays on waste canisters containing small amounts of uranium, and the larger tube enables measurement of fuel packages of various shapes containing large quantities of uranium. A hard-copy operations terminal located in the crane corridor above the DNI cubicle is used to operate the DNI. This location allows the operator visual access for positioning and moving samples to and from the DNI tubes. The assay system is controlled by complex software programs (initiated through simple commands) that perform diagnostics and system checks, and then the sequential operations required to properly complete measurements. This report describes the design of the control system and electronic components composing the DNI.

32768 (LA—9902-MS) Coincidence measurements of FFTF breeder fuel subassemblies. Eccleston, G.W.; Foley, J.E.; Krick, M.; Menlove, H.O.; Goris, P.; Ramalho, A. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 23p. (ISPO—199). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014132.

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A prototype coincidence counter developed to assay fast breeder reactor fuel was used to measure four fast-flux test facility subassemblies at the Hanford Engineering Development Laboratory in Richland, Washington. Plutonium contents in the four subassemblies ranged between 7.4 and 9.7 kg with corresponding ^{240}Pu-effective contents between 0.9 and 1.2 kg. Large count rates were observed from the measurements, and plots of the data showed significant multiplication in the fuel. The measured data were corrected for deadtime and multiplication effects using established formulas. These corrections require accurate knowledge of the plutonium isotopics and ^{241}Am content in the fuel. Multiplication-corrected coincidence count rates agreed with the expected count rates based on spontaneous fission-neutron emission rates. These measurements indicate that breeder fuel subassemblies with ^{240}Pu-effective contents up to 1.2 kg can be nondestructively assayed using the shift-register electronics with the prototype counters. Measurements using the standard Los Alamos National Laboratory shift-register coincidence electronics unit can produce an assay value accurate to +-1% in 1000 s. The uncertainty results from counting statistics and deadtime-correction errors. 3 references, 8 figures, 8 tables.

32769 (LA-UR—84-1959) Estimation methods for special nuclear materials holdup. Pillay, K.K.S.; Picard, R.R. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840734—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014035.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The potential value of statistical models for the estimation of residual inventories of special nuclear materials was examined using holdup data from processing facilities and through controlled experiments. Although the measurement of hidden inventories of special nuclear materials in large facilities is a challenging task, reliable estimates of these inventories can be developed through a combination of good measurements and the use of statistical models. 7 references, 5 figures.

32770 (NBL—311) Progress report for the period October 1982-September 1983. (USDOE New Brunswick Lab., Argonne, IL). May 1984. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013668.

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The mission activities of the New Brunswick Laboratory to provide and maintain a standards and measurements laboratory in support of the programmatic responsibilities of the Department of Energy, Office of Safeguards and Security, the regulatory functions of the Nuclear Regulatory Commission, and the international commitments of the US to assure the application of accurate and reliable measurement technology in the safeguarding of special nuclear materials are summarized.

32771 **(SAND—84-0463C) Maintenance and the upgraded security system.** Ledbetter, D.M.; Martin, J.P. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA); Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 6p. (CONF-840734—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013059.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Many facilities have installed or are planning to install upgraded security systems involving state-of-the-art electronic equipment, intrusion detection sensors, closed circuit TV systems, and active delay components with associated command and control systems. While this equipment may provide the required support for the security forces when it is installed, it can and will become a burden and yield degraded security if it is not properly maintained. This condition can exist even though it is not obvious to the operators. A program embodied in the operation of the facility is required to assure that the system continues to perform as it was designed. Recommended approaches to this problem are addressed and benefits to be gained from dedicated security maintenance teams are discusssed based on experience gained during operation of the Pantex Plant physical security system and from assisting in the implementation of upgraded systems at many DoD facilities.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

32772 (INIS-BR—120, pp 200) **Neutron generators.** Silva, A.A. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

0701 Physical Isotope Separation

32773 (INIS-mf—8921, pp 56) **Plasma source for a centrifuge.** Dothan, F. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

Published in summary form only.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 33966, 34101

0703 Isotopic Power Supplies

32774 **(LA—9680-SR) General-Purpose Heat Source Development: safety test program. Postimpact evaluation, Design Iteration Test 1.** Schonfeld, F.W. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014173.

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The General-Purpose Heat Source (GPHS) provides power for space missions by transmitting the heat of $^{238}PuO_2$ decay to thermoelectric elements. Because of the inevitable return of certain missions, the heat source must be designed and constructed to survive re-entry and Earth impact. The Design Iteration Test (DIT) series is part of an ongoing impact test program. The first DIT used a full GPHS module containing two graphite impact shells (GISs); each GIS contained two iridium (0.3 wt%) capsules filled with $^{238}PuO_2$. It was impacted at 57 m/s and 930°C. All four fuel capsules survived and none was breached. However, serious cracking of the iridium-alloy capsules was found; some cracks extended through ~ 70% of the wall thickness. Postimpact analyses of the unit are described with emphasis on weld structure and performance. 51 figures.

32775 **(LA—10075-MS) Beneficial uses of ^{241}Am.** Mangeng, C.A.; Thayer, G.R. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013918.

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This report assesses the uses of ^{241}Am and the associated costs and supply. The study shows that ^{241}Am-fueled radioisotope thermoelectric generators in the range of 1 to 5 W electrical provide the most promising use of kilogram amounts of this isotope. For medical uses, where purity is essential, irradiation of ^{241}Am can produce 97% pure ^{238}Pu at $21,000/g. Using a pyro-metallurgical process, ^{241}Am could be recovered from molten salt extraction (MSE) residues at an estimated incremental cost of $83/g adjusted to reflect the disposal costs of waste products. This cost of recovery is less than the $300/g cost for disposal of the ^{241}Am contained in the MSE residues.

08 HYDROGEN

0801 Production

32776 **(BNL—34689) Summary status of advanced water electrolysis and hydrogen storage/transport R and D.** Mezzina, A. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 19p. (CONF-8405122—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012908.

From International symposium on hydrogen produced from renewable energy; Manoa, HI, USA (24 May 1984).

Major projects within the framework of the U.S. DOE Chemical/Hydrogen Energy Systems Program are described. Goals, accomplishments and status of investigations into advanced water electrolysis and hydrogen storage/transport are summarized. Electrolytic hydrogen production systems include: SPE electrolyzers; static feed water electrolysis; high temperature electrolysis; and other advanced concepts. Hydrogen transport studies have emphasized the characterization of hydrogen embrittlement effects on conventional natural gas pipeline steels.

32777 **(BNL—34731) H^+ and OH^- electrolytes for the 300° to 600°C range.** Findl, E.; Kulesa, F.; Montoneri, E. (Brookhaven National Lab., Upton, NY (USA); Politecnico di Milano (Italy). Dipartimento di Chimica Industriale e Ingegneria Chimica). 1984. Contract AC02-76CH00016. 6p. (CONF-840804—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011913.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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A research program has been initiated to screen and select electrolyte materials for use in steam electrolyzers in the 300 to 600°C temperature range. Screening of a significant number of acid anhydrides, hydroxides, oxides, and phosphates for their electrolytic conductivity properties is underway. Of the binary materials examined to date, only polymerized phosphoric acid, immobilized on an H^+ substituted zeolite, shows promise. A substantial number of ternary compounds remain to be synthesized and evaluated.

32778 **(FRNC-TH—1512) Study of mechanism of thermolysis of steam in a cylindrical reactor between 1700-1900 K.** Abdul Aziz, G. (Rouen Univ., 76 - Mont-Saint-Aignan (France)). Feb 1982. 171p. (In French). NTIS (US Sales Only), PC A08. Order Number DE84751737.

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Solar thermal energy can be used for hydrogen production from steam. In this paper is studied a reactor for thermal energy transmission to a water flow to produce a partially dissociated steam flux. For practical reasons solar energy is simulated by electric heating. Preheated steam is introduced in a high temperature oven in zirconia, pressure is maintained at 25 torrs by a pump and temperature is measured by thermocouples. The molar fraction is

determined by a mass spectrometer. Experimental results in the range 1700K to 1900K are reported and interpreted and kinetic models are deduced. High temperature should be investigated.

32779 **Immobilized chloroplast-ferredoxin-hydrogenase system for the simultaneous photoproduction of hydrogen and oxygen.** Woodward, J.; Greenbaum, E. (Oak Ridge National Lab., TN). *Biotechnology and Bioengineering Symposium;* No. 13, 271-276(1983). (CONF-830567—). Contract W-7405-ENG-26.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

The chloroplast-ferredoxin-hydrogenase (CFH) system is capable of the simultaneous photoproduction of hydrogen and oxygen using water as the source of electrons. The immobilization of chloroplasts and hydrogenase, which has been the subject of several reports has been attempted in order to increase their storage and functional stability. However, immobilized chloroplasts and hydrogenase have never been shown to produce hydrogen and oxygen simultaneously. The simultaneous photoproduction of hydrogen and oxygen is a valuable guide in assessing the role of water as the primary substrate in biophotolysis. As has been shown previously, the stoichiometric ratio of hydrogen to oxygen is, in general, not equal to 2. By measuring the oxygen that is produced along with the hydrogen, it is possible to set an upper limit on the photoproduced hydrogen that is derive d from water. The study reported here describes for the first time the simultaneous photoproduction of hydrogen and oxygen by the CFH system immobilized in calcium alginate gel spheres. 15 references, 4 figures.

0802 Storage

REFER ALSO TO CITATION(S) 32776

32780 **(BNL—34830) Kinetics of the absorption of hydrogen by LaNi$_5$H/sub x//n-undecane suspensions. Part I. The H$_2$/LaNi$_5$H/sub x//n-undecane system.** Reilly, J.J.; Johnson, J.R. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 19p. (CONF-8404106—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013090.

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

Isothermal kinetic studies of the absorption of hydrogen by LaNi$_5$H/sub x/ suspended in n-undecane have been performed. The rate limiting process is the dissolution of H_2 in the solvent. A general rate equation is given, $dH_2/dt = 1/2\ ks\ (a''-a')$, where ks is the rate constant for the absorption of H_2 by the solvent; $(a''-a')$ represents a thermodynamic driving force which is determined by the equilibrium solubility of H_2 in the solvent and the equilibrium absorption plateau pressure of the solid. The rate constant is defined as k/sub s/ = A/sub s/exp(-E/sub s//RT) where E/sub s/ is the activation energy for dissolution of H_2 in the solvent and is equal to 11.0 +- 1.1 kJ/mol H_2. The pre-exponential, A/sub s/, is a function of the efficiency of the gas-liquid contact. The rate equation should have general utility and can be used with other hydrides suspended in n-undecane as long as the rate limiting process is unchanged. A new method for the study of fast reactions involving the dissolutions of H_2 in liquids is discussed. The H_2 absorption and desorption rates are well within the range required for practical applications. 10 references, 3 figures, 2 tables.

32781 **(BNL—34831) Kinetics of the absorption of hydrogen by LaNi$_5$H/sub x//n-undecane suspensions. Part II. The H$_2$/n-undecane system.** Johnson, J.R.; Reilly, J.J. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 16p. (CONF-8404106—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013091.

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

In order to adequately treat the absorption kinetics of LaNi$_5$H/sub x//n-undecane suspensions a knowledge of the thermodynamic and kinetic behavior of the H_2/undecane system is required. The system obeys Henry's Law, P/sub H_2=N/sub H_2/K/sub H/, where N/sub H_2/ is the H_2 mol fraction. K/sub H/ varies with the temperature according to ln K/sub H/ (atm) = 455/T+5.69. The relative partial molal heat of solution, Δ anti H/sub H_2/, is 3.8 kJ (mol H_2)$^{-1}$. The absorption rate of H_2 in undecane was found to obey a first-order kinetic equation, dH_2/dt = k/sub s/$(a''-a)$, where dH_2/dt is the rate of H_2 solution, a'' is the initial amount of reactant H_2 and a is the amount of H_2 solution, a'' is the initial amount of reactant H_2 and a is the amount of H_2 solution dissolved at any time t. At a pressure of ~ 1000 kPa and between 273 to 323K, k/sub s/ = A/sub s/ exp(/sup -E/s/RT); where the activation energy, E/sub s/. is 11.1 kJ (mol H_2)$^{-1}$. A/sub s/ is dependent on the efficiency of the gas-liquid contract and thus varies with reactor design, stirring speed, etc. In our experiments, carried out in a baffled reactor at a constant stirring speed of 600 rpm, A/sub s/ = 16.1 sec^{-1} and the reaction was essentially complete in ~ 20 sec. 9 references, 4 figures, 1 table.

0803 Transport

REFER ALSO TO CITATION(S) 32776

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 33546

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 32442

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 32525, 32532, 32566, 32798

32782 **(DOE/CS/24310—4) Full scale field demonstration of unheated anaerobic contact stabilization.** Sykes, R.M.; Fan, K.S. (Ohio State Univ., Columbus (USA)). Sep 1983. Contract AC02-80CS24310. 345p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84013546.

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A full scale field demonstration of unheated anaerobic digestion, including both solids recycle and solids nonrecycle processes, was conducted at the Jackson Pike Wastewater Treatment Plant at Columbus, Ohio. Two digesters (locally called Tanks 4E and 6E) at this facility were used for this purpose. In the experimental system, the operating temperature was reduced gradually from 91°F to 63°F. There were eight periods in the Recycle Phase and four periods in the Nonrecycle Phase. Gas production, solids destruction, volatile fatty acid variation, alkalinity, and pH were monitored in each period. In addition, grease, long-chain fatty acids, and foaming were intensively investigated at the last two periods, C and D, of the Nonrecycle Phase. The objectives of this research were: (1) evaluation of the unheated anaerobic digestion in full scale field units, and (2) and development of criteria for design and operation of a cold anaerobic digester. 48 references, 41 figures, 84 tables.

32783 **(DOE/CS/40202—T11) Conversion of cellulosic wastes to liquid hydrocarbon fuels. Technical progress report, May 1-31, 1984.** Kuester, J.L. (Arizona State Univ., Tempe (USA). Dept. of Chemical Engineering). 1984. Contract AC02-76CS40202. 7p. (COO—2982-103). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013271.

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Progress achieved during the month of May 1984 is reported. The major efforts in this reporting period were aimed at (1) achieving sustained (>8 hrs) steady state data periods in the continuous integrated system (gasification + liquefaction) at product yields in the 40 to 60 gals/ton range; (2) determine minimum steam/carbon ratios for gasification; (3) determine pyrolysis reactor scrubber water characteristics; (4) set up new product analysis equipment; and (5) implement system improvements. The subcontractor has prepared preliminary site plans and building elevations and is proceeding with topographic surveying and obtaining geo-

technical data for the ASU designated site. Preliminary design of processing equipment is in progress. The major concern at present is the choice of compressor type compatible with eventual commercial scale (~ 300 to 1000 tons/day). The water-seal types successfully tested in the laboratory apparently are not manufactured with anywhere near the capacity required for a commercial scale facility. It is felt that any alternative type should be initially process tested on the laboratory scale. 1 figure.

32784 **(DOE/ER/12058—3) Promoter modifications of catalytic activity and selectivity. Final report, April 1, 1982-March 31, 1984.** Falconer, J.L. (Colorado Univ., Boulder (USA). Dept. of Chemical Engineering). 30 Apr 1984. Contract AC02-82ER12058. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013690.

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The effect of alkali promoters on the activity and selectivity for CO hydrogenation was studied on supported nickel catalysts. Temperature-programmed desorption and reaction, and steady-state reaction were used. The support was shown to have a strong influence on the changes induced by the alkali promoter. On Ni/SiO_2 and Ni/TiO_2, hydrogenation rates were significantly reduced, apparently due to weakened hydrogen bonding. This resulted in a significant increase in the olefin selectivity. On $Ni/SiO_2.Al_2O_3$, the hydrogenation rates were increased, and a maximum was observed in the rates of methane and higher paraffin formation. Little change in the Ni/Al_2O_3 catalysts was seen, except for a decrease in surface area. Temperature-programmed reaction and steady-state kinetics show good agreement for the series of catalysts. On Ni/Al_2O_3, the presence of multiple reaction sites was observed and studied in detail; a model was developed. The effect of potassium concentration on Ni/SiO_2 was large and the activity decreased rapidly even at the low concentrations. Preparation method and alkali salt used were shown to have small effects on the changes in activity and selectivity. The strong effect of the support was attributed to an interaction of the support with the promoter.

32785 (DOE/METC—84-8, pp 107-115) **Metal-support interaction studies on clean metal surfaces.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—). Contract AC21-82MC19204.

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The goal of our study is to discover which properties of the catalyst are changed by metal-support interactions and how these property changes affect the reaction rate. Special emphasis will be given to determine differences in the heats of adsorption for CO and H_2 on methanation catalysts in the presence of different support oxides since apparent changes in the adsorption isotherms have been observed. These differences in the heats of adsorption will then be correlated to the specific reaction rates to discover what fundamental changes in the adsorption properties lead to observed reactivity differences. Preliminary results show clearly that there are changes in the chemsorption properties of CO and H_2 on Pt in the presence of SiO/sub x/. 5 figures.

32786 **(DOE/PC/30022—10) Slurry Fischer-Tropsch/Mobil two stage process of converting SYNGAS to high octane gasoline. Final report.** Kuo, J.C.W. (Mobil Research and Development Corp., Paulsboro, NJ (USA)). Jun 1983. Contract AC22-80PC30022. 326p. NTIS, PC A15/MF A01; GPO Dep. Order Number DE84004411.

An evaluation study was conducted on a novel two-stage slurry Fischer-Tropsch/ZSM-5 process for converting low H_2/CO ratio synthesis gas, which can generally be obtained from highly efficient, advanced coal-gasification systems, into high quality gasoline. The feasibility of this two-stage technology was successfully demonstrated in a newly designed and constructed bench-scale unit (BSU), consisting of a slurry bubble column reactor followed by a fixed-bed ZSM-5 reactor. Three Fischer-Tropsch catalysts of $Fe/Cu/K_2CO_3$ type were evaluated. Total hydrocarbon production as high as 815 g/gFe was achieved, which is substantially better than other results reported in the literature. Methane + ethane yields ranged from 2 to 18 wt % of total hydrocarbons produced, with reactor-wax (those heavy hydrocarbons retained in the slurry reactor under reaction conditions) yields ranging from 3 to 85 wt %. Other investigations of the first-stage operation included process variable and hydrodynamic studies. The second-stage ZSM-5 reactor performed smoothly and demonstrated the conversion of Fischer-Tropsch products into high quality gasoline. The gasoline yields, including the alkylate and excluding the reactor-wax and light paraffins in the feed to the second-stage reactor, were as high as 87 wt %. The raw gasoline samples had satisfactory stability properties. A conceptual process design and scoping cost estimate for a battery-limit commercial plant to produce 27,000 BPSD gasoline from clean synthesis gas was conducted. The estimated cost is $700 million in terms of 1983 dollars at a Wyoming location.

32787 **(PB—84-178409) Methane from biomass and waste. Annual technical progress report.** Smith, W.H. (Florida Univ., Gainesville (USA). Inst. of Food and Agricultural Sciences). Jan 1983. 102p. NTIS, PC A06/MF A01.

This report summarizes the research conducted at the University of Florida on the production of methane from biomass and waste. It presents data on biomass yield studies on a wide variety of plant species which have potential to serve as a biomass source for methane production in future years. Species reported include woody, freshwater aquatics, grasses and related plants, root plants and marine plants. Over two-hundred and fifty plants have been subjected to a variety of bioassays for methane yields. Research directed toward improved conversion of biomass to methane is reported which covers the conversion spectrum from the molecular level to the cellular level to the level of conversion in unique anaerobic digesters. A comprehensive information management system has been established and systems studies have been undertaken and a preliminary model is reported.

32788 **(PB—84-179753) Microbiological and biochemical studies towards optimization of substrate utilization by methanogenic bacteria. Annual report Dec 82-Dec 83.** Ferry, J.G. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Dec 1983. 35p. NTIS, PC A03/MF A01.

The microbiology and biochemistry of acetate conversion to methane was studied. A new acetotrophic methane-producing organism (Methanosarcina acetivorans) was isolated and characterized which showed that it is uniquely suited for biochemical and genetic studies. This organism and other acetotrophic and methylotrophic methane-producers were genetically classified by DNA-DNA and DNA-RNA homologies. This cell material was used to study the biochemical pathway of acetate metabolism to methane. Properties of the carbon monoxide dehydrogenase and methylreductase components of this system were studied in detail. This organism also contained cofactor B and a new cofactor (FAF) recently discovered in H2-oxidizing methane-producers. The results suggest that these enzymes and cofactors may be involved in the pathway. Whole cells of acetotrophic and methylotrophic methane-producing strains, examined by electron paramagnetic resonnance spectroscopy, revealed novel redox centers in the soluble and membrane fractions.

32789 **(PNL-SA—11448) Liquid fuels from biomass: an overview of research activities funded by DOE's thermochemical conversion program.** Stevens, D.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 17p. (CONF-8310195—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013264.

From Industrial wood energy forum; Nashville, TN, USA (15 Oct 1983).

The United States Department of Energy is sponsoring research on the thermochemical conversion of biomass into useable energy forms. This research effort is divided into three technology areas including gasification, liquid fuels, and combustion. In this paper, the organization of the program and a technical overview of present liquid fuels technology research are presented.

32790 **(SERI/TP—231-2348) Fuel from microalgae lipid products.** Hill, A.M.; Feinberg, D.A. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1984. Contract AC02-83CH10093. 17p. (CONF-840493—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84004506.

From Energy from biomass technical review meeting; Portland, OR, USA (23 Apr 1984).

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The large-scale production of microalgae is a promising method of producing a renewable feedstock for a wide variety of fuel products currently refined from crude petroleum. These microalgae-derived products include lipid extraction products (triglycerides, fatty acids, and hydrocarbons) and catalytic conversion products (paraffins and olefins). Microalgal biomass productivity and lipid composition of current experimental systems are estimated at 66.0 metric tons per hectare year and 30% lipid content. Similar yields in a large-scale facility indicate that production costs are approximately six times higher than the average domestic price for crude, well-head petroleum. Based on achievable targets for productivity and production costs, the potential for microalgae as a fuel feedstock is presented in context with selected process refining routes and is compared with conventional and alternative feedstocks (e.g., oilseeds) with which microalgae must compete. 24 references, 9 figures, 4 tables.

32791 **Alternative fuels for general aviation. Hearing before the Subcommittee on Transportation, Aviation, and Materials, U.S. House of Representatives, Ninety-Eighth Congress, First Session, August 29, 1983.** Washington, DC; Government Printing Office (1983). 213p.

Five witnesses representing general aviation and aviation fuel industries and the Federal Aviation Administration testified on the potential for using alternative fuels in general aviation to counteract the effects of high prices and supply vulnerability on the industry. The witnesses described test results of liquid methane and alcohol fuels, noting that those fuels which most closely emulate the properties of petroleum will best serve the industry's needs. Their testimony covered environmental and economic effects as well as fuel performance. The Synthetic Fuels Corporation, DOE, National Aeronautics and Space Administration, and the Department of Defense, as well as the aviation industry have research programs on aviation fuels.

32792 **Composition of gas produced by large scale anaerobic digestion of municipal solid waste.** Narasimhan, R.; Gerrish, H.P.; Sengupta, S.; Daly, E.L. Jr.; Nemerow, N.; Wong, K.V.; Voorhees, S.A. (Univ. of Miami, Coral Gables, FL). pp 171-176 of Resource recovery from solid wastes. Sengupta, S.; Wong, K.F.V. (eds.). Elmsford, NY; Pergamon Press Inc. (1982). (DOE/EV/10671—1; CONF-820565—). Contract AS05-78EV10133.TI83005317

From Conference on resource recovery from solid wastes; Miami Beach, FL, USA (10 May 1982).

This paper gives the composition of gas produced by the large-scale anaerobic digestion of municipal solid waste in the mesophilic and thermophilic temperature range. It is found that the composition of methane is higher in the thermophilic range when the retention time is 20 days or more. Our data did not agree with the relationship between the composition of gas versus temperature, pH and alkalinity as found in literature. 6 references, 1 figure, 3 tables.

32793 **Surface electronic properties and CO hydrogenation activity of nickel deposited on rutile TiO_2(100) as a model supported catalyst.** Kao, C.C.; Tsai, S.C.; Chung, Y.W. (Northwestern Univ., Evanston, IL). *Journal of Catalysis;* **73**: 136-146(1982). Contract AC02-78ER04946.

A combined ultrahigh-vacuum surface analysis-high-pressure cell system has been used to study the electronic properties and CO hydrogenation behavior of nickel deposited on single-crystal rutile TiO_2(100) as a model supported catalyst. Photoemission studies show that nickel atoms at the Ni/TiO_2(100) interface are negatively charged. In situ CO hydrogenation studies at a total pressure of 80 Torr have been performed on Ni/TiO_2(100) and Ni(111) from 170 to 270°C. The methane turnover number of Ni/TiO_2(100) is a function of the Ni coverage and attains a maximum at an average Ni thickness of 5 A. The methanation activity of 5A Ni/TiO_2 is a factor 3.3-3.7 times that of Ni(111), with an accompanying shift of the product distribution toward higher hydrocarbons. 44 references, 11 figures.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 32530

32794 **(DOE/PC/30019—T11) Liquid Phase Methanol Process Development Unit: installation, operation, and support studies. Technical progress report No. 10, 1 January-31 March 1984.** (Air Products and Chemicals, Inc., Allentown, PA (USA); Chem Systems, Inc., Tarrytown, NY (USA)). 20 Apr 1984. Contract AC22-81PC30019. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84012293.

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This extremely significant 10th quarter was highlighted by the successful shakedown operation of the LaPorte PDU. Obstacles to start-up, which included exotherms in the unit and the presence of carbonyls, were eliminated. For the successful 10-day PDU shakedown operation, 900 lb of EPJ-19LR catalyst were used. Methanol was produced from both balanced and CO-rich synthesis gas at various operating conditions, and ranged from 1.8 to 8.5 tpd. The highest catalyst productivity achieved during the run was 1.75 lb of methanol/lb catalyst-h, which is significantly higher than can be achieved in gas phase synthesis. Catalyst attrition was significant; the catalyst extrudates in the ebullated-bed reactor rapidly attrited. The catalyst formed an 18 wt % slurry by the end of the run. However, during the transition from ebullated to slurry catalyst, the PDU and catalyst performed very well, and catalyst activity remained high. Support work at CSI continued with autoclave testing of a new catalyst candidate for liquid-entrained operations, and with other miscellaneous tests for hydrodynamic characterization of catalyst powders. At APCI, a 250-h test using an ICI catalyst on balanced gas at a 37 wt % loading was successfully completed in the 300-cc autoclave. The results are very encouraging with respect to maximizing productivity on a reactor volume basis. To complete the data base on catalyst aging, a gas phase activity maintenance run was successfully conducted. The results suggest that CO may be important in catalyst deactivation for gas phase methanol synthesis. 6 references, 32 figures, 28 tables.

32795 **(HNEI—80-03) Hawaii Ethanol from Molasses Project, Phase I. Final report.** Chen, C.S,; Gibson, W.O.; Mashima, K.I.; Roberts, R.R.; Rezachek, D.A.; Krill, K.; Hsu, D.; Stanley, R.W. (Hawaii Univ., Manoa (USA). Hawaii Natural Energy Inst.). Apr 1980. Contract AC03-79ET23141. 197p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84014845.

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The purpose of this study was (1) to determine the best available commercial processes in the manufacture of anhydrous ethanol from molasses, (2) to determine those processes in the research and development stage that have the potential of becoming commercial, and (3) from these determinations to recommend the conceptual design of a plant which incorporates the best processes. The following ethanol production processes have been firmly selected as being the best available: (1) co-generation of steam and electricity, (2) molasses acidity adjustment, dilution, sterilization, centrifugation, and nutrient addition; (3) continuous fermentation; (4) yeast recycling and drum-drying excess yeast; (5) pressure differential distillation; and (6) dehydration with cyclohexane or ether. A number of environmentally acceptable alternative processes for handling stillage were evaluated, and the following recommendations were made: (1) recycling 20% ds stillage should be practiced; (2) producing an animal feed directly from the stillage is the preferred process for handling stillage providing the amount produced and its value are confirmed by pilot-plant production and animal feeding trials; (3) should the above pilot-plant production and animal feeding trials prove negative, stillage incineration with potassium recovery is the preferred option; (4) deep ocean discharge of stillage should be considered only as a temporary option; and (5) producing methane is not a viable option. It was suggested that in Hawaii, with its temperate climate, it may be feasible to use a fuel consisting of gasoline and 96% ethanol instead of anhydrous ethanol (99.6%). The effects on energy requirements and costs of producing 96% ethanol were determined and compared to those ef-

fects from the production of anhydrous ethanol. 13 references, 26 figures, 23 tables.

32796 **(NP—4770269) Homogenous high pressure hydrogenation of carbon monoxide using cobalt, ruthenium and iridium catalyst.** Anstock, M. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 30 Nov 1982. 182p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770269.

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Within the framework of this dissertation an attempt was made to convert synthesis gas to low molecular oxygen containing compounds using homogeneous catalysts. Depending on the conditions of reaction major products obtained were formic acid methyl ester, methanol, ethanol, or ethylene glycol, and by-products formed were formic acid ethyl ester, acetic acid methyl ester, n-propanol, ethylene glycol formiate, 1,2-propandiol and glycerol. Cobalt, iridium and ruthenium compounds were used as catalysts in this synthesis where pressures of 2000 bar are required. A comparison of the catalyst metals cobalt, ruthenium and iridium revealed the highest activity with ruthenium compounds. The cobalt-based system, on the other hand, led the highest yields of ethylene glycol.

32797 **(PNL-SA—12259) Progress in studies on catalyzed gasification of biomass.** Baker, E.G.; Mudge, L.K.; Brown, M.D. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 27p. (CONF-8405157—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013259.

From 16. biomass thermochemical conversion contractors meeting; Portland, OR, USA (8 May 1984).

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The Pacific Northwest Laboratory (PNL) is conducting an ongoing project, sponsored by the Biomass Energy Technology Division of the U.S. Department of Energy, on the gasification of biomass in the presence of catalysts. The purpose of the project is to evaluate the technical and economic feasibility of producing specific gas products throught the catalytic gasification of biomass. This report presents the results of research conducted since the 15th Biomass Thermoconversion Contractors's Meeting and current project status. Laboratory studies have determined the mechanism of carbon deposition on secondary catalysts. Types of catalysts that minimize carbon deposition have been identified. These studies have also provided a fundamental understanding of the effects of both primary and secondary catalysts. This included a review of the state of the art of catalysis as it applies to biomass gasification. The process development unit (PDU) was successfully operated using bagasse from Australia as a feedstock. Both primary and secondary catalysts were used. The economics of producing methanol from bagasse were evaluated and the economics of a wood-to-methanol plant were updated from 1980 to 1983. A bench-scale gasification system (1 to 3 kg/h) is being built to provide the capabilities of the PDU gasifier system at a lower cost. The primary goal of the bench-scale studies to to demonstrate that carbon deposition on catalysts and catalyst attrition can be controlled at acceptable rates in a fluidized bed. 32 references, 3 figures, 8 tables.

32798 **Fifth symposium on biotechnology for fuels and chemicals.** Scott, C.D. (ed.). New York, NY; John Wiley and Sons, Inc. (1984). 672p. (CONF-830567—). John Wiley and Sons, Inc., 605 Third Avenue, New York, NY 10158.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

The five main topics dealt with in this conference were: thermal and chemical processing of biomass (acid hydrolysis, enzyme hydrolysis, catalytic cracking); bioconversion research (culture of bacteria, control of fermentation processes, use of cocultures and immobilized cells for biomass conversion); bioprocess research and development (ethanol fermentation, methane production, enzyme stability); bioprocess engineering (genetic engineering, economic analyses, lignin potential, algae harvesting); and separation processes for ethanol and other chemicals. Most of the 53 papers have been abstracted separately. 904 references, 291 figures, 185 tables.

32799 **Production of ethanol from biopolymers by anaerobic, thermophilic, and extreme thermophilic bacteria. I. Regulation of carbohydrate utilization in mutants of Thermoanaerobacter ethanolicus.** Carreira, L.H.; Wiegel, J.; Ljungdahl, L.G. (Univ. of Georgia, Athens). *Biotechnology and Bioengineering Symposium;* No. 13, 183-191(1983). (CONF-830567—). Contract AS09-79ER10499.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

One mutant of T. ethanolicus JW200 Fe(4) was characterized by studying fermentations of xylose, glucose, cellobiose, and soluble corn starch and mixtures of two or three of these substrates. JW200 Fe(4) does not show diauxic growth characteristics if xylose and hexose are supplied together. However, in mixtures, glucose is used prior to the breakdown of cellobiose or starch. 13 references, 5 figures.

32800 **Production of ethanol from biopolymers by anaerobic, thermophilic, and extreme thermophilic bacteria. III. Thermoanaerobacter ethanolicus JW200 and its mutants in batch cultures and resting cell experiments.** Wiegel, J.; Carreira, L.H.; Mothershed, C.P.; Puls, J. (Univ. of Georgia, Athens). *Biotechnology and Bioengineering Symposium;* No. 13, 193-205(1983). (CONF-830567—). Contract AS09-79ER10499.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Several thermophilic and extreme thermophilic anaerobic bacteria can utilize hemicellulose (xylan polymer) from birch- and beechwood directly. Thermoanaerobacter ethanolicus JW200 exhibited the highest ethanol formation, although the extracellular xylanase and xylosidase activities were very low. All bacteria rapidly utilized xylose before the polymers were utilized at a lower rate. With resting cell suspensions of T. ethanolicus and its mutants, the ethanol formation rates were as high as 60 mmol (2.76 g) and 30 mmol (1.3 g) ethanol per liter per hour from glucose and xylose, respectively. After 1 hour the ethanol productions in the concentrated cell suspensions were linear for over 10 hours from glucose or xylose; however, with soluble starch (DE 10) the rates were increasing with time. From these experiments it is concluded that the contiuous culture experiments with hemicellulosic material and/or starch have to be performed with recycling of the cells and the extracellular enzymes. 25 references, 6 figures, 3 tables.

32801 **Product inhibition of Zymomonas mobilis: evidence for two inhibitors.** Worden, R.M.; Donaldson, T.L.; Shumate, S.E. (Oak Ridge National Lab., TN). *Biotechnology and Bioengineering Symposium;* No. 13, 265-269(1983). (CONF-830567—). Contract W-7405-ENG-26.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Batch-growth experiments were conducted in New Brunswick model C-30 fermenters having a 350-ml working volume. Temperature and pH values of 36°C and 6.0, respectively, were maintained using automatic controllers and a 2M KOH titrant. The growth medium contained 10% (w/v) glucose, 0.5% yeast extract (Difco), 0.1% KH_2PO_4, 0.05% $MgSO_4 \times 7H_2O$, 0.1% $(NH_4)_2SO_4$, and 0.01M succinate. These culture conditions were found in a previous study to provide maximal initial growth and ethanol production rates for Z. mobilis (ATCC 10988). Growth medium was prepared and autoclaved (121°C for 25 min) with the sugar separate from the remaining solutes to prevent darkening of the solution. After autoclaving, all components were combined, and the medium was allowed to cool under a nitrogen atmosphere to maintain anaerobic conditions. The medium was then spiked with the desired amount of 95% ethanol just prior to inoculation with Z. mobilis. The reactors were then sampled periodically to monitor biomass and ethanol concentrations. 8 references, 2 figures, 1 table.

32802 **Ethanol production in a fluidized-bed bioreactor utilizing flocculating Zymomonas mobilis with biomass recycle.** Scott, C.D. (Oak Ridge National Lab., TN). *Biotechnology and Bioengineering Symposium;* No. 13, 287-298(1983). (CONF-830567—). Contract W-7405-ENG-26.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Bench-scale, fluidized-bed bioreactor systems are being used to convert glucose to ethanol by particles of a flocculating strain of Zymomonas mobilis; ethanol production rates in excess of 600 g/l-h have been achieved. The systems have been operated successfully for extended periods (500 h) while using unsterilized feed with glucose concentrations in the range 100 to 160 g/l. The primary bioreactor was also operated in the absence of necessary nutrients but coupled to a small secondary reactor in which the biomass particles were recycled and exposed to small amounts of the nutrients. 11 references, 6 figures, 3 tables.

32803 **Thermochemical conversion of biomass to ethanol.** Jenkins, D.M.; Huffman, W.J.; Allen, B.R. (Battelle Memorial Inst., Columbus, OH). *Biotechnology and Bioengineering Symposium;* No. 13, 557-566(1983). (CONF-830567—).

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Thermochemical conversion of biomass to ethanol should be considered as an alternative to the conventional fermentation technologies. The thermochemical conversion of biomass consists of three steps: the hydrolysis of holocellulose to five and six carbon sugars, the conversion of sugars to lactate salts, and the pyrolysis of lactate to ethanol. Major coproducts of the process are acetic acid, butanediol, and an oxygenated hydrocarbon which has not been completely identified. A preliminary economic evaluation indicates that the overall process has economically attractive features. 4 references, 5 figures, 4 tables.

32804 **Small-scale continuous distillation.** Eley, M.H.; Schroer, B.J.; Adcock, L.E. II. (Univ. of Alabama, Huntsville). *Biotechnology and Bioengineering Symposium;* No. 13, 663-668(1983). (CONF-830567—).

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Studies on commercially available batch distillation units had shown these units to have very high capital cost, poor performance characteristics, and a negative energy balance. Although several well-known pioneers in continuous farm-scale ethanol production have been successful, basic information on the design, fabrication, costs, and operation of such facilities has not been widely disclosed to the agricultural community. The first objective of this study was to design a small-scale continuous distillation unit capable of producing 10-15 gal/h of 170-190 proof ethanol. Additional design parameters were to utilize readily available materials, to minimize costs, to incorporate features that would permit easy replication, and to require only modest skills for fabrication. The second objective was to economically fabricate the unit. Fabrication skills were limited to modest welding and plumbing with a minimum of manhours of labor. The third objective was to thoroughly evaluate the unit with emphasis on production potential, operational considerations, and energy balance. The fourth objective was to compare the unit with a perforated plate and a packed rectifying column.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 32607, 32845

32805 **(ANL/CNSV-TM—134-Vol.2) Study of existing RDF-cofiring experience. Volume 2. Appendixes to Phase I final report.** Fiscus, D.E.; Ege, H.D.; Petersen, R.D.; Glaub, J.C.; Joensen, A.W.; Wolfs, K.E.; Savage, G.M. (Midwest Research Inst., Kansas City, MO (USA)). Oct 1983. Contract W-31-109-ENG-38. 397p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84013104.

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The purpose of Phase I is to collect and assemble all relevant data from the experience of cofiring refuse derived fuel (RDF) in electric utility suspension fired and cyclone fired boilers. This was accomplished through both questionnaires and site surveys. Appendix A contains case study reports while Appendices B and C contain test data obtained from the questionnaires for power plants and RDF processing plants respectively. 68 figures, 128 tables.

32806 **(VTT-TIED—197) Flame control of the fire-grate by digital technigues. Preliminary study.** Haapanen, P.; Lilja, R.; Ollus, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Mar 1983. 33p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland. Order Number TI84751039.

Television cameras for controlling the burning in fire-grate furnaces using wood wastes are discussed. The report is a preliminary report of the research concerning digital technique applications for controlling the fire-grate furnaces. Various kinds of fire-grates and their adjusting principles are presented.

13 HYDRO ENERGY

1301 Resources And Availability

32807 **(PB—84-157809) Development of small scale hydro-schemes. Part 1. Rapid assessment.** (Foras Forbartha Teoranta, Dublin (Ireland)). 1984. 23p. NTIS, PC E03/MF E03.

Prepared in cooperation with Electricity Supply Board, Dublin (Ireland). Sponsored in part by Department of Industry and Energy, Dublin (Ireland).

This manual, which comes in two parts, is intended as a guide to individuals who wish to develop water power privately. This booklet will assist the individual in assessing the potential of a particular site for future power generation and give an indication of the problems and cost involved.

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 32812, 32819

32808 (CONF-8110328—, pp 137-148) **Z'Mutt compensating basin and sediments.** Bezinge, A.; Bonvin, G. 1981. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The Z'Mutt compensating basin with a volume of 850'000 m^3, receives decanted glacial waters as well as rinsing waters from sand removers. Afterwards, these waters are pumped up in the main free flow tunnel and conducted into the Grande Dixence storage. This study exposes two important problems: - the deposit mechanism of 20-35'000 m^3 sands and muds in the basin and their evacuation each autumn, - the decantation mechanism and the transport of solid materials throughout the basin. The influence of floating particles on the wear of centrifugal pumps with a description of the means allowing to extend the time between maintenance works.

32809 **(DOE/ID/12201—T2) Field test of ultra-low head hydropower package based on marine thrusters. Final report.** (Energy Research and Applications, Inc., Santa Monica, CA (USA)). Dec 1983. Contract FC07-80ID12201. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013685.

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The project includes the design, fabrication, assembly, installation, and field test of the first full-scale operating hydropower package (turbine, transmission, and generator) based on a design which incorporates a marine-thruster as the hydraulic prime mover. Included here are: the project overview; engineering design; ultra-low head hydropower package fabrication; component procurement, cost control, and scheduling; thruster hydraulic section installation; site modeling and resulting recommended modifications; testing; and baseline environmental conditions at Stone Drop. (MHR)

1305 Economics And Management

32810 (CONF-8110328—, pp 241-247) **Repair of the Palagnedra spillway after the flood of 1978.** Trucco, G. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

During the exceptional flood of August 7, 1978, the Palagnedra dam, belonging to the Maggia Power Plant Company was overtopped and its diaphragm wall on the right bank suffered severe damage. Moreover the flood carried also 25'000 m^3 of wooden debris and logs, and approx. 1.8 mio m^3 of alluvial material into the basin. The present report describes the repair of the damages and the remodeling of the spillway to avoid similar flushing of the basin to restore its original capacity.

32811 **(PB—84-157015) Small hydro-electric potential west Poverty Bay region. Final report.** (New Zealand Energy Research and Development Committee, Auckland). Jul 1981. 70p. (R—66). NTIS, PC E04/MF E01.

This study has identified six schemes in the Bay of Plenty Electric Power Board area and two in the Poverty Bay Electric Power Board area, of which five and one respectively are below the economic limit of $2400/kW suggested by the Ministry of Works and Development as of December 1979. Of these, only three appear both economic and environmentally acceptable.

1306 Environmental Aspects

32812 (CONF-8110328—, pp 9-25) **Silting of storage areas in rivers and lakes.** Vischer, D. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

An introduction into problems of sedimentation in water reservoirs (rivers and lakes) in general and in Switzerland is presented from the view of hydroelectric power development. The major part of sediments in water reservoirs consists in silt. Reasons of sedimentation and some adequate means are shown to slow down or even prevent the process of sitting up: filtering silt of inflows to the reservoir, preventing erosion (e.g. by foresting), constructing, compensation basins, dredging and scouring of sediments.

32813 (CONF-8110328—, pp 27-40) **Storage loss.** Graf, W.H. 1981. NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Empirical methods to determine loss of storage in water reservoirs by calculation and measuring are reviewed: 1) Trap efficiency of a reservoir (i.e. its ability to trap and/or to retain the entering sediments). It depends on particle size, reservoir size, inflow ratio and others. 2) Distribution of sediments, depending on reservoir site, depth, zero elevation, sediment type and others. 3) Reservoir sedimentation surveys practiced by sonic equipment, terrestrial surveying or aerial photogrammetric equipment. 4) Measuring and control methods for reservoir sedimentation such as control of watershed, control of inflow, of sedimentation and removal of sediments.

32814 (CONF-8110328—, pp 41-48) **Origin of fine-grained sediment in reservoirs as a function of the geological situation in the source areas.** Ammann, M. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Investigations of fine-grained sediments from four Swiss reservoirs are compared with samples collected from affluents. It is shown that the quantity of fine-grained sediment is strongly dependent on the geological situation in the source areas. By means of two water reservoirs the results of the sediment samples are shortly described (Lake Siehl and Bacino di Val Malvaglia).

32815 (CONF-8110328—, pp 49-56) **Simulation model for calculating sedimentation in water reservoirs.** Plate, E.J.; Ihringner, J.; Treiber, B. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The calculation of the reservoir deposition with the application of mathematical simulation models for the optimization of reservoirs is of great importance. The sedimentation of the wash load in a reservoir will be demonstrated by means of simplified reservoir geometry, and thus the current change in time of the reservoir bed will be determined.

32816 (CONF-8110328—, pp 57-65) **Time-dependent degradation of sediment accumulation during the scouring of storage basins.** Schoeberl, F. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Concerning the time-dependent degradation of sediment accumulations a modified formula is presented, based on the results of W. Willi's experiments and directly considering the influence of the involved sediment material. Futhermore some equations are given for the time-exponential reduction of erosion activity and of selfstabilisation by armoring at the end of the erosion process.

32817 (CONF-8110328—, pp 67-72) **Echo-depth sounding and evaluation in order to detect and record sedimentation in water-reservoirs.** Straub, T.C. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Suitable measurement techniques and procedures for surveying of sediment deposits in reservoirs, applying echo-sounding equipment will be described.

32818 (CONF-8110328—, pp 73-80) **Hydro power station Eglisau - periodical survey of the sedimentation 1919-1980.** Pfeiffer, C. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The methods to measure river profiles to determine the alteration of the riverbed are shown at the example of the Rhineriver power station Eglisau. This plant belongs to the North-East-Swisse power company (NOK).

32819 (CONF-8110328—, pp 81-88) **Silting and removing problems in the storage zone of the hydraulic power plant Eglisau.** Morf, J. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The effluents deposit big quantities of sedimentary materials in the uppermost part of the storage zone of the Hydraulic Power Plant Eglisau (Owner and Operator is Nordostschweiz. Kraftwerke AG, Baden. Construction period 1915-1920). These deposits raise the ground water level and menace to wet the adjacent cultivated land. It is necessary to remove the deposited sediments periodically 760'000 m^3 of material were removed out of the Rhine river bed in three dredging campaigns.

32820 (CONF-8110328—, pp 89-97) **Silting-up of the Klingnau storage-lake from 1935 until today.** Baechli, L. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The silting-up of the Klingnau storage-lake, beginning immediately after impounding in 1935, caused a reduction of the storage volume from initially 7 Mio m^3 to 3 Mio m^3. The lake bottom has been well sealed by the deposition of soil. A complete sealing effect for the lake embankments did not, however, result from the depositions. The state of aggradation has slowly stabilized to become permanent and shows clearly that the river Aare is forming again its original course but at a higher level. The degree of inundation possible for the silted-up areas will, however, still be limited by the embankments.

32821 (CONF-8110328—, pp 99-106) **Sedimentation in the Bremgarten-Zufikon-reservoir on the Reuss river.** Jaeggi, M.; Lambert, A.; Smart, G. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Sedimentation processes in the reservoir and in the lacustrine realm of Unterlunkhofen are investigated by field measurements and numerical simulation. This procedure provides an approximation of the silting-up progress.

32822 (CONF-8110328—, pp 115-127) **Silting-up of the reservoirs of hydroelectric generating stations on the Swabian-Bavarian rivers Iller, Guenz, Wertach and Lech.** Schiechtl, H.; Rapp, R.; Hillenbrand, G. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The electricity supply bodies LEW, BEW and BAWAG operate at the above mentioned rivers a total of 32 hydroelectrical generating stations with river reservoirs. After some introductory remarks on geographics, geological and hydrological features and on the development and extension of these rivers, as well as the quotation of data relating to the economics of energy supply, the silting-up of the reservoirs is dealt with. The report should be treated as a collection of material; details are explained with reference to some examples.

32823 (CONF-8110328—, pp 129-135) **Silt measurement and monitoring on Rhine canal sections between Basle and Strasbourg.** Soyer, G. 1981. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The author describes EDF methods for monitoring the development of silt deposits on Rhine canal sections between Basle and Strasburg as well as removel technics designed to insure uninterrupted flow of flood-waters and maintenance of normal cross-section of the international navigable channel.

32824 (CONF-8110328—, pp 149-155) **Problems of siltation in three compensating basins at Linth-Limmern power scheme.** Baechtiger, O. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The deposits in the basins consist of mud and fine sand. The floor slope of the basins is too small to permit flushing of the deposits. Since appropriate storage areas are not available a procedure with restitution to the river had to be developed. After initial difficulties good results were achieved by a combination of mechanical scratching and well dosed flushing.

32825 (CONF-8110328—, pp 157-163) **Silting-up and scouring of the small Innerferrera reservoir of the Hinterrhein Hydroelectric Scheme.** Willi, W. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

During the 20 year long operation, it was possible to scour and drag 31% of the deposits of solid material out of the reservoir. About 90% of the total sediment load passed through the reservoir without settling. Today the settled materials cause a reduction in storage volume of 37%. The observations made during scouring operations are compared with the results of the model tests and with relationships derived theoretically. Good agreement is obtained.

32826 (CONF-8110328—, pp 165-174) **Model tests for flushing of bed load sediment from the upper end of the compensating reservoir Rempen of AG Kraftwerke Waegital.** Huber, A. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Flushings are performed through a by-pass tunnel. The total weight of flushed material was measured continuously by a sediment balance. The results give a relation between flushed bed load, water discharge and flushing time.

32827 (CONF-8110328—, pp 175-182) **Fine material deposit and flushing of the surge pond of Mattsand.** Fux, C. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The quantity of solid materials carried down the Mattervispa river is very considerable. Due to this high solids contents, several 10,000 m^3 of fine material are annually deposed in the 210,000 m^3 Mattsand surge pond. The grain size of the deposed material is less than 0.2 mm. Various methods for cleaning out the pond have been tried. The results of experience, numerous tests and observations have led to a annual flushing of the pond.

32828 (CONF-8110328—, pp 183-196) **Sedimentation and erosion in the reservoir of Ferden.** Volkart, P. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The mechanism of sedimentation and erosion in the reservoir of Ferden had been investigated in a 1:50 hydraulical model. The grain size distribution and the beginning of sediment transport had been determined in situ before. The annual bed load yield had been estimated before the tests. During the first 5 years of operation the sedimentation process in the prototype was documented with photographs. Good agreement was found with the model test results which is also due to the extensive field investigations before the tests.

32829 (CONF-8110328—, pp 197-205) **Flushing of sediments at the Gebidem-Dam.** Giezendanner, W.; Dawans, P. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The flushing of sediments at the Gebidem-Dam occurs in a satisfactory way since 13 years. The results of the hydraulic model tests are confirmed. Just the volume of water necessary for the purges proves to be less than expected. The owner of the scheme has since improved the operation procedure and found the optimum conditions for flushing.

32830 (CONF-8110328—, pp 207-214) **Sedimentation in the Grimsel reservoir.** Rueegsegger, P. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The paper discusses the sedimentation problems in the Grimsel Reservoir. Model tests and the measures taken to keep sedimentation under control are reported.

32831 (CONF-8110328—, pp 215-222) **Silting-up in the Etzelwerk.** Ziegler, A. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

This contribution on the Sihlsee-reservoir summarizes its management, its catchment area behavior and the possibilities of sediment input reduction by selected river control works. A recent bathymetric survey has revealed areas of silting-up and erosion. However it would be interesting to investigate if this "erosion" could be the result of sedimentary compaction effects.

32832 (CONF-8110328—, pp 223-232) **Experience with a sediment trap on the Emme river upstream of the weir at Flumenthal.** Markwalder, R.; Chervet, A. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Since 1969 a sediment trap has been working on the Emme river just upstream of its confluence with the Aare river. Its purpose is to catch the bed load transported by floods in the Emme river. The volume of the trap is about 40,000 m^3. Model tests were made to check the dimensions and function of the sediment trap. Experience with the prototype showed that the trap is functioning satisfactory. About 17'000 m^3 of sediment has been trapped per year.

32833 (CONF-8110328—, pp 233-239) **Flood disaster 1978 in the compensation basin of Palagnedra.** Martini, O. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

From the beginning, a considerable sedimentation had been ascertained in the compensation basin of Palagnedra. Pumping at first and the construction of a discharge tunnel then, was the guarantee for the operation of the power plant, until the flood of 78 took place, damaging the whole plant (basin - dam - under pressure system - power plant). The restoration works caused a 10 months out of operation of the power plant.

32834 (CONF-8110328—, pp 249-256) **Experience with clearance of storage areas at the Tauernkraftwerke AG plants in Salzburg.** Hofer, F. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

After the demonstration of the storage power stations run by the Tauernkraftwerke, the methods of the removal of geolocial deposit are exposed. The utilization of natural depository basins is alluded to. Economically expensive clearing attempts by suction dredges are also mentioned and details about a successful modification of a ground outlet are given.

32835 (CONF-8110328—, pp 257-270) **Scouring of sediments in small and medium scaled water reservoirs.** Krumdieck, A.; Chamot, P. 1981. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The useful volume of relatively small reservoirs can be maintained at all times provided that the operation of the reservoir allows to flush it periodically with a free flow condition. The requirements for the success of such sediment flushings are an appropriate topographical configuration and an adequate design of the bottom outlet. The cleaning of reservoirs by means of flushing under free flow conditions is the most effective and economical solution. Criteria are given how to design a bottom outlet in order to get a perfect flushing even under extreme conditions. An example illustrates the method of such flushings successfully feasible without affecting the economy of the reservoir.

32836 (CONF-8110328—, pp 271-278) **Dam of Ksob (Algeria).** Stucky, J.P. 1981. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

Design of a sediment by-pass. The Ksob dam was heightened in 1977 in order to increase its storage capacity. A sediment derivation tunnel by-passing the reservoir was designed for a second stage. It will be operated during floods and is expected to delay significantly important storage losses due to reservoir sedimentation.

32837 (CONF-8110328—, pp 279-288) **Intake elevation of the bottom discharge of the Grande Dixence dam.** Bezinge, A.; Aeschlimann, R. 1981. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number TI84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

The bottom discharge is a security organ for the maintenance and the exploitation of the dam all the more that this latter is not equipped with an overflow. Because of the accumulation of excavated materials from the dam foundations and a large transport of mud which had settled at the bottom of the dam, the level of the initial water intake has be come to low. The study describes the elevation work of the intake, carried out in 12 days only. We hope that this correction allows an operation of the storage without any difficulties in the next 40 to 50 years.

32838 **(CONF-8110328—) Silting of storage areas and reservoirs in the Alpine region.** (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaciologie). 1981. 285p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84770265.

From International experts' meeting on silting of storage areas and reservoirs in the Alpine region; Zurich, Switzerland (22 Oct 1981).

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Separate abstracts were prepared for individual papers.

32839 **(PB—84-178003) CO_2 (carbon dioxide) fire protection study for hydrogenerators: report of findings.** Chadwick, R.W.; Klataske, L.F.; Osburn, G.D. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Feb 1984. 30p. NTIS, PC A03/MF A01.

Large generating and pump-generating units are protected by automatic CO_2 fire-protection systems. A review is made of the power industry control philosophy for CO_2 discharge. Guidelines are given on ionization detectors, manual-electrical CO_2 discharge, manual-mechanical CO_2 discharge, electrical CO_2 discharge control circuit, safety, and reliable operation.

1307 Power Conversion Systems

32840 **(DOE/ID/12201—T3) Application of marine thrusters as ultra-low head hydroturbines.** (Energy Research and Applications, Inc., El Segundo, CA (USA)). Jan 1984. Contract FC07-80ID12201. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013096.

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The results of the first field test of an ultra-low head hydropower unit based on a marine thruster are presented. Testing was initiated in December 1982 and resumed in April 1983, coincident with the irrigation season. Use of a modified marine thruster as a hydroturbine was successfully demonstrated, though power output was lower than calculated as further explained in this test report. Installation and test was at Stone Drop on the MID Main Canal. Flow during test was 500 to 540 cfs at 16 ft of head. Maximum scheduled canal flow is 1100 cfs. Flow is available throughout the District's eight month irrigation season. In the as built final site configuration, the thruster was operating at 13 ft of effective head and 386 cfs flow. Power output is 235 kW under these conditions. At this installed capacity, typical annual generation is 1,353,600 KWHRS with actual energy output dependent on the irrigation period.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 33233

1401 Resources And Availability

32841 (DOE/CS/60014—2) Planning and zoning for solar access. A guide for Minnesota communities. (Minnesota Dept. of Energy and Economic Development, St. Paul (USA). Energy Div.). Sep 1983. Contract FG45-76CS60014. 87p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84012695.

The purpose of this guide is to provide information on solar energy systems, solar access issues and protection techniques to enable planners, zoning administrators, and local elected officials to: Remove barriers to the use of solar energy in zoning ordinances and subdivision regulations; facilitate the access of solar systems in new and existing developments to sunlight by changes in zoning ordinances and subdivision regulations; and implement techniques to guarantee solar access.

32842 (LBL—17649) Solar irradiance: the effect of dimensionality on solar spectrum curves. Casti, T.E.; Otvos, J.W. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014136.

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The shape of the solar irradiance curve and the location of its maximum are dependent upon the units chosen for expressing irradiance and therefore upon the experimental method of making the measurements. Some of the confusion resulting from this fact could be eliminated if relative bandwidth were used instead of the more conventional wavelength bandwidth or wavenumber bandwidth. Formulae are given and curves are shown for expressing solar irradiance (6000°K black body) in all three ways and with respect to both power and photon rate.

32843 (PB—84-152305) Availability of NBS (National Bureau of Standards) radiometric standards for solar irradiance studies. Final report. Madden, R.P. (National Bureau of Standards, Washington, DC (USA)). 1980. 8p. Pub. in Proceedings of Workshop Solar UV Irradiance Monitors, Boulder, CO., 31 Jul-1 Aug 80, p79-86.

The development of primary and secondary radiometric standards at the National Bureau of Standards is a responsibility of the Center for Radiation Research, in the National Measurement Laboratory. Three different standards available from NBS are given.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 32534, 32566, 32778, 32779, 32783, 32787, 32789, 32790, 32795, 32797, 32798, 32799, 32800, 32801, 32802, 32803, 32804, 32805, 32806, 32942, 34380, 34388

32844 (AD-A—138938/6) Low-cost GaAs solar cell development. Final report Sep 81-Sep 83. Ludowise, M.J. (Varian Associates, Palo Alto, CA (USA). Solid State Lab.). Dec 1983. 71p. NTIS, PC A04/MF A01.

An abbreviated program to design and develop a thin, low-cost GaAs solar cell for space applications is described. Due to funding limitations, the scheduled four-year program was terminated at the two-year point. Several growth runs utilizing the metal organic-chemical vapor phase (MO-CVD) epitaxial process were made in an attempt to optimize the solar cell structure. Both p/n and n/p growths were made with varying emitter thickness and doping levels. Cell thinning for selected cells was successful to less than 10 microns using a special stop-etch technique. These cells were covered prior to thinning to provide strength and reduce the probability of breakage.

32845 (BMFT-FB-T—84-066) Further development and practical use of plants for energy generation from wood and straw in agriculture (rural area). Strehler, A.; Heins, F.; Schulze Lammers, P.; Wasensteiner, J.; Langer, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.)). Apr 1984. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751775.

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Aside of market investigation for several furnace systems and reflections about power generation technical problems of combustion of waste and the tests of different systems had been the basic research work. The efficiency of through burning and bottom burning boilers had been improved. Own constructions of bottom burning boilers were developed to the stage of prototypes. One furnace with automatical charging of chopped straw and woodchips had been developed, this construction is free to be copied by industry. For big woodchips and short woodlogs a prefurnace with bottom burning systems was built. A market investigation study for different types of furnaces shows that in straw combustion there is still a big market potential to be used. Several hot air generators were developed for drying purposes, they are available on the market place meanwhile. More than 20 pilot plants were planned and attended in practice.

32846 (DOE/ER/10531—T1) Influence of the interfacial layer on electrooptical properties of heterojunction solar cells. Final report. Anderson, R.L. (Vermont Univ., Burlington (USA)). 19 Oct 1983. Contract FG02-79ER10531. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013285.

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We have investigated the influence on the photovoltaic characteristics of the interfacial (I) layers of silicon oxide which spontaneously form in heterojunction solar cells with Si as active substrate material and SnO_2, In_2O_3 and indium-tin oxide (ITO) as windows. We have verified the reported dependence of the growth rate of the I layer on the Si conductivity type but we disproved the hypothesis that the increased degradation rate of cells with n-Si substrates compared to those with p-Si substrates results from field-enhanced diffusion of O_2^- ions. We have preliminary results which suggest that the conversion efficiency is largely controlled by the sign and quantity of interfacial charge. For large values of open circuit voltage, as required in cells of high efficiency, this charge is positive for cells using p-Si substrate and negative for n-Si based devices. The charge is apparently a result of the fabrication method.

32847 (DOE/JPL/955640—83) Development and fabrication of a solar cell junction processing system. Draft final report. (Spire Corp., Bedford, MA (USA)). Jun 1984. Contract NAS-7-100-955640. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013469.

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A program was undertaken to develop, construct and deliver to JPL a processing system capable of producing solar cell junctions by ion implantation followed by pulsed electron beam annealing. The machine was to be capable of processing 4-inch diameter single-crystal wafers at a rate of 10^7 wafers per year. A microcomputer-controlled pulsed electron beam annealer with a vacuum interlocked wafer transport system was designed, built and demonstrated to produce solar cell junctions on 4-inch wafers with an AMI efficiency of 12%. Experiments showed that a non-mass-analyzed (NMA) ion beam could implant 10 keV phosphorous dopant to form solar cell junctions which were equivalent to mass-analyzed implants. A NMA ion implanter, compatible with the pulsed electron beam annealer and wafer transport system was designed in detail but was not built because of program termination.

32848 (DOE/JPL/956205—83/6) Development of metallization process FSA Project, cell and module formation research area. Quarterly technical progress report for the period ending September 30, 1983. Garcia, A. III. (Spectrolab, Inc., Sylmar, CA (USA)). Nov 1983. Contract NAS-7-100-956205. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84004603.

The initial evaluation of the matrix of pastes has been completed. Cells made with these pastes showed high contact and bulk resistance. Shunt resistance was not a problem.

32849 (DOE/JPL/956381—84/1) Evaluation of the ion implantation process for production of solar cells from silicon sheet materials. Final report, 15 December 1982-1 December 1983. Spitzer, M.B. (Spire Corp., Bedford, MA (USA)). Dec 1983. Contract NAS-7-100-956381. 88p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84014177.

This report describes research on the evaluation of the ion implantation process for junction formation in present-day sheet materials, including Czochralski, edge-defined film-fed growth, heat exchanger method, SEMIX, SILSO and dendritic web. Both furnace annealing and low temperature pulsed electron beam annealing are examined and the presence of temperature effects is identified. It is shown that efficiency can be increased by optimization of the thermal processing. A comparison of ion implantation to alternative processes is made. The manner in which high efficiency may be achieved with each of these materials is discussed.

32850 (DOE/JPL/956698—84/2) Process research of polycrystalline silicon material (PROPSM). Quarterly report No. 2, January 1, 1984-March 31, 1984. Culik, J.S. (Solarex Corp., Rockville, MD (USA)). 1984. Contract NAS-7-100-956698. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013353.

The intent of this program is to develop a passivation process (hydrogenation) that will improve the power generation of solar cells fabricated from presently-produced, large-grain, cast polycrystalline silicon (Semix), a potentially low-cost material. The program will consist of two phases. The first objective will be to verify the operation of a DC plasma hydrogenation system and to investigate the effect of hydrogen on the electrical performance of a variety of polycrystalline silicon solar cells. The second objective will be to parameterize and optimize a hydrogenation process for cast polycrystalline silicon, and will include a process sensitivity analysis. The sample preparation for the first phase is outlined. The hydrogenation system is described, and some early results are summarized that we have obtained using our hydrogenation system without a plasma. Light-beam induced current (LBIC) measurements of minicell samples, and their correlation to dark current-voltage characteristics, are discussed.

32851 (FRNC-TH—1320) Electrical properties of submicronic emitters. Application to the case of solar cells and subnanosecond hyperfrequency transitors. Gomina, M. (Caen Univ., 14 (France)). Dec 1981. 113p. (In French). NTIS (US Sales Only), PC A06. Order Number DE84750801.

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This paper aims at specifying the importance of the main mechanisms which determine the electrical properties of doped p-n junctions until the degenerescence, and of depths below one micron. A concrete aim of this work is the study of the efficiency of injection of the emitter-base junction of subnanosecond bipolar transitors, as also the electrical characteristics of solar cells. These devices are made of silicon. In a first part, the photovoltaic effect, and the technology of solar cells are briefly reviewed; the results of the simple theory of the p-n junction are recalled. In the following part, the contribution of the different regions of the device to the dark current are explained. The relative values of hole and electron currents are discussed, taking into account the values of the main physical parameters in the devices: depth of the junction, concentration gradient in the diffused region, life-time of minority carriers in the emitter, concentration of acceptors in the base. This will allow to point out the parameters of which modifications would lead to a lower value of the dark current; thus, would involve a more important value of the open-circuit voltage. In the third part, a new method to determinate the impurities concentration in the diffused region in the vicinity of the junction, is presented. The emitter regions of the submicronic devices being strongly doped, the performance of these devices are expected to be influenced by a very short life-time of the AUGER type and by a reduction of the width of the energy gap. In the fourth part, the main models of reduction of the width of the energy gap proposed in the literature, are discussed. The fifth part sums up the results of calculation of gain on hyperfrequency NPN type transistors according to the models for strong doping previously discussed.

32852 (FRNC-TH—1517) Filtration and methane fermentation of microscopic algae. Algamar, K. (Montpellier-2 Univ., 34 (France)). Jul 1982. 189p. (In French). NTIS (MF) (US Sales only). Order Number DE84751736.

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Experimental study of the dynamics of anaerobic digestion, on immersed filters, of microscopic algae, in view of the development of a process which combines, in the same reactor, the collection of algae and intensive fermentation of the fixed biomass.

32853 (NE—1983-6) Terminals for raw products of wood. Present situation and future development. Loenner, G.; Liljeblad, H.; Hjaelm, B.; Strand, H.-O.; Lindqvist, L. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Feb 1983. 255p. (In Swedish). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84751009.

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The goal of this study was to define the concepts of wood processing terminals which are the most interesting ones to develop during the 80ies, to give technical specifications for such components that should be developed, and to propose a programme for continued R and D. The concepts are presented in the form of layouts flow charts and technical descriptions. It has been necessary to make several simplifications and generalizations since the concepts in real life situations are strongly influenced by a number of local conditions. Separately are brief discussions of the possibilities of placing equipment for debarking of chips at the terminals and terminals with stumps as raw material. In the latter case it is concluded that only small modifications need to be made if the stumps are properly cleaned prior to the delivery to the terminals. Storage, drying and pelletizing are described separately, since all terminal concepts presented were designed for undried fuel chips as main product. An economic comparison between the alternative terminal concepts is given. The value of general calculations of the type made in this study is limited. Two main lines can be separated: terminals with mainly mobile equipment and terminals with stationary equipment. Need for government support to R and D exists for terminals with mobile equipment. For the terminal techniques specifically,The following R and D projects are recommended for

governmental support. 1 Research - Study of problems with dirty raw material - Study of chips debarking. 2 Component Development. 3 Pilot Plants (full scale).

32854 **(NE—1983-9) Energy from forest. Project results 3065 09 forest energy.** Nilsson, P.O. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Mar 1983. 48p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751010.

The Forestry Energy Project at the Swedish University of Agricultural Sciences started in 1977 with the objective to develop necessary knowledge for an increased use of wood fuel in Sweden in order to substitute imported oil. The aim is to describe and analyse systems and machine components to be used in harvesting, transportation, storage and conversion of various forestry energy resources, such as logging residues - tops, branches and stumps from clear cuts - and small trees from thinnings. The systems shall be applicable to demands posed by different categories of forest owners and be designed with consideration to good economy, high availability, and the demand for good working conditions as well as the conservation of nature. The project is financed by the National Swedish Board for Energy Source Development, the total support for the five years July 1977 - June 1982 being close to 15 million Swedish Crowns. In this summary report of the first five years a survey is given of the results obtained so far in view of the general development in the field.

32855 **(NE—1983-18) Biological production of energy carriers and chemicals from peat and wood. A literature study.** Hahn-Haegerdahl, B.; Mattiasson, B.; Nilsson, J.L. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1983. 149p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751006.

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The potential for producing energy and chemicals from peat and wood using biological processes either solely or integrated with thermal, physical and chemical processes has been reviewed on the basis of current literature reports. The availability of the raw material in Sweden and its chemical composition are reported. Energy related products and oil sparing chemicals which might be produced from peat and wood have been identified. Prices and markets have - when possible - been estimated. Advantages and disadvantages of mechanical, thermal and chemical pretreatments of lignocellulosic materials have been reviewed. Special emphasis has been given to the relation between pretreatments and the extremely high water content of peat. Biotechnological treatments such as enzymatic hydrolysis and fermentation of lignocellulosic materials are reported. Methanogenesis and inhibited methanogenesis are especially discussed. Available process technology and future process technologies derived from current research programs have been summarized.

32856 **(PB—84-163450) Study of coupling and protecting solar arrays of photovoltaic cells with the aim of obtaining high direct current voltages. Final report.** Forge, F. (Commission of the European Communities, Luxembourg). 1982. 48p. (In French). (EUR—8143-FR). NTIS, PC E03/MF E03.

Arrays of photovoltaic cells may be used as rural power sources, but are subject to problems in cases of short circuit, open circuit, or masking of individual elements. The breakdown voltage values for a selection of cells are examined as well as the theoretical consequences for different cell assemblies following cell failure.

32857 **(PB—84-163567) Study and promotion of epitaxial growth of compounds III/5 by the mixed pyrolysis of organometallics and hydrides at reducted pressure: application to the study of solar cell structures.** Gave, G.; Le Metayer, M.; Orgeret, M. (Commission of the European Communities, Luxembourg). 1983. 25p. (EUR—8207-FR). NTIS, PC E03/MF E03.

The study of the epitaxial growth of Group III/5 elements in semiconductors by organometallic methods and based on the heterostructure GaAlAs/GaAs, has been reported previously. A study of this low pressure technique has enabled production of photovoltaic solar cells. The parameters influencing growth have been investigated, in particular, length, temperature, pressure, and concentration. However, because the reducing property of Al in GaAlAs gives rise to difficulties, the use of the homostructure GaAs has been suggested. A photovoltaic gallium arsenide solar cell was therefore produced by the above method, using the MESA technique for making eight solar cells on a substrate. The output of the device is presented. The technique appears to offer a simple method for producing solar cells.

32858 **(PB—84-163633) Study of the technology of a solar module offering good thermal dissipation. Final report.** Diguet, D.; Anguet, J. (Commission of the European Communities, Luxembourg). 1982. 72p. (In French). (EUR—8159-FR). NTIS, PC E04/MF E04.

The first phase of RTC's research program to develop a solar module involved the investigation of possible ways for fixing cells to a dissipative support and their correlation with the theoretical study of the thermal module. The program was divided into three parts: (1) the evaluation of different types of materials and support structures in practical trials to establish the most promising initial solutions, (2) the development of a model to analyze the relative importance of the parameters influencing thermal dissipation and its verification by measurements on an actual module, and (3) the analysis of the samples of dissipating modules chosen to estimate the benefits brought about by the different structures and to refine the previously developed thermal model.

32859 **(PB—84-163864) Seaweed raft and farm design in the United States and China.** McKay, L.B. (New York Sea Grant Inst., Albany (USA)). 1983. 108p. NTIS, PC A06/MF A01.

Sponsored in part by New York State Energy Research and Development Authority, New York, Gas Research Inst., Chicago, IL, and New York Gas Group, NY.

The following topics are discussed in this report: pilot-scale mariculture of seaweeds in Washington; experimental-scale raft culture of marine macroalgae in inland marine waters; macroalgal culture in California and China; land-based cultivation of seaweeds: an assessment of their potential yields for 'energy farming'; a design for energy-independent seaweed raft culture in tidal creeks and rivers; and the New York State marine biomass program.

32860 **(PB—84-164532) Study of improvements to Schottky diodes on amorphous silicon, prepared by cathodic sputtering. Final report.** Vieux-Rochaz, L. (Commission of the European Communities, Luxembourg). 1982. 51p. (In French). (EUR—8195-FR). NTIS, PC E04/MF E04.

Schottky diodes on amorphous hydrogenated silicon have been successfully prepared, each layer of the structure having been deposited by cathodic sputtering. Electrical measurements show that the diodes are good quality rectifiers with a current saturation in darkness of the order of 10 to the minus 12 power A/sq cm and barrier levels reaching 1.2eV under illumination of 100mW/sq cm; certain diodes deliver a short-circuit current of 10mA/sq cm and an open circuit voltage of 600mV without having an anti-reflection layer. It is shown that an anti-reflection layer, likewise deposited by cathodic sputtering, increases the short-circuit current by 43% and ensures good protection of the cells against the action of harmful atmospheric gases.

32861 **(PB—84-169085) Appropriate technology: results of studies by the Mechanical Engineering Department of the University of the Andes.** (Universidad de Los Andes, Bogota (Colombia). Centro de Estudios e Investigacion). 1983. 315p. (In Spanish). (D—1). NTIS, PC A14/MF A01.

This report presents 89 summaries of appropriate technology projects in the fields of agroindustry, central heating, biomass, wind energy, hydraulics, civic works, refrigeration, water treatment, and agricultural waste. Each summary gives sufficient information to decide whether one should initiate such a project, the results obtained, and the people and organizations who obtained these results.

32862 (SAND—83-2375C) Thermal conductivity and interface resistance of particle-filled silicone resin. Schwinkendorf, W.E.; Moss, M. (BDM Corp., Albuquerque, NM (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 8p. (CONF-840816—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011681.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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The thermal conductivity of silicone resin containing various amounts of Al_2O_3, MgO, BN and copper particles was measured with a Colora Thermoconductometer. Samples consisted of aluminum and alumina discs bonded with unfilled or particle-filled resin. Most particle loaded samples displayed a conductivity that declined with decreasing bond thickness. This is due to a measurable interface thermal resistance which probably results from the increased viscosity and reduced wetting ability of particle-loaded resin. Microscopic examination of bond cross sections revealed such areas of incomplete contact. No interface resistance was observed for unfilled resin where wetting appeared complete.

32863 (SAND—84-0053C) Comparative evaluation of new low-cost array field designs for grid-connected photovoltaic systems. Post, H.N.; Noel, G.T. (Sandia National Labs., Albuquerque, NM (USA); Battelle Columbus Labs., OH (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840804—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010978.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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New array field designs which have been developed to minimize the balance-of-system (BOS) cost for grid-connected photovoltaic (PV) systems are examined. Previous experience with intermediate-size systems experiments has shown the array field BOS to be a major cost contributor to PV systems, with BOS costs in the range of $5/W/sub p/ and up. These new designs which are appropriate for both intermediate and large-size ground-mounted flat plate arrays have significantly reduced the BOS cost. Key features of the array field BOS components including structures, foundations, intermodule connection, field wiring, and system grounding are identified for each design. Cost projections as well as cost experience on prototype and full-scale installations are presented and compared. It is concluded that $0.50/W/sub p/ for the array field BOS is achievable for large - size systems.

32864 (SAND—84-0244C) Concentrating photovoltaic technology. Edenburn, M.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 16p. (CONF-840845—1). NTIS, PC A02/MF A01. Order Number DE84012275.

From 10. annual conference of the Solar Energy Society of Canada; Calgary, Canada (2 Aug 1984).

This paper will summarize the status and discuss likely future directions of photovoltaic concentrator technology. A current commercial Si cell module has a peak efficiency of 15.5%, and 17% has been reached with an experimental module. Advanced cells and module design improvements offer still higher efficiencies. Concentrator Fresnel lens array fields installed several years ago have all demonstrated very good electrical performance with little performance degradation. Fresnel lens arrays were commercially available and prices of $7/watt for installed one megawatt systems have been quoted. Cost projections predict that current technology concentrating PV arrays can be installed for less than $2/watt if they are manufactured in large, steady quantities. More advanced designs may cost even less.

32865 (SERI/STR—211-2308) Cadmium sulfide/copper ternary heterojunction cell research semiannual report, 1 July 1983 - 31 December 1983. Devaney, W.E.; Mickelsen, R.A.; Chen, W.S.; Hsiao, Y.R.; Stewart, J.M.; Olsen, L.C.; Rothwarf, A. (Boeing Engineering and Construction Co., Seattle, WA (USA)). May 1984. Contract AC02-83CH10093. 171p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84004511.

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The properties of polycrystalline, thin-film $CuInSe_2$/CdS and CdZnS solar cells prepared by vacuum evaporation techniques onto metallized alumina and glass substrates are described. Cells on glass substrates are reported to show higher V/sub oc/'s but lower I/sub sc/'s than alumina substrate cells. Preparations for the deposition of CuIn/sub 1-x/Ga/sub x/Se_2 films in a planetary apparatus and initial results on annealing of $CuInSe_2$ films in H_2Se environments are discussed. Thermally Stimulated Capacitance (TSCAP) and Isothermal Capacitance Transient Spectroscopy (ICTS) results on $CuInSe_2$ cells are reported. The development of film and device analysis techniques including SEM, EDS and EBIC are described and typical results are presented. Low temperature (12°K) photoluminescence of $CuInSe_2$ films excited with a He-Ne laser is discussed along with a proposed energy level model. Finally, results are presented from two subcontractors (Drexel University and JCGS) pertaining to cell analysis and theoretical cell mechanism studies.

32866 (SERI/TP—212-2323) CdS/$CuInSe_2$ heterojunction cell research. Noufi, R.; Axton, R.; Cahen, D.; Deb, S.K. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 7p. (CONF-840561—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84004508.

From 17. IEEE photovoltaic specialists conference; Kissimmee, FL, USA (1 May 1984).

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The objective of this research is (1) to fabricate and characterize $CuInSe_2$ thin films and (2) to fabricate and characterize CdS/$CuInSe_2$ solar cells. The material can be deposited either n- or p-type with mobilities of up to 150 cm^2/V s and carrier concentrations ranging from 10^{13} to 10^{20} cm^{-3}. X-ray diffraction reveals a single phase with strong preferred orientation along <211> and <112> directions. The basic device structure of the cell consists of two $CuInSe_2$ layers, varying in the stoichiometry of elements and electrical properties, and two layers of CdS. Composition studies as well as electrical property measurements of the two layers were carried out to illustrate the role of the two layers of $CuInSe_2$. The methods used and results are discussed in detail and a conclusion is drawn as to whether the two layers in an actual device can be eliminated by using a single layer of intermediate composition and electrical properties.

32867 (SERI/TR—9171-1-T2) Low-cost silicon substrates by directional solidification. Final report. Schmid, F.; Khattak, C.P. (Crystal Systems, Inc., Salem, MA (USA)). Dec 1982. Contract AC02-77CH00178. 93p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84011552.

A one-year effort was carried out to evaluate the use of directional solidification of commercially available metallurgical grade (MG) silicon by the Heat Exchanger Method (HEM) to produce substrates suitable for solar cell fabrication. Metallurgical grade (MG) silicons from numerous sources world-wide were evaluated and it was found that the impurity content varied depending upon the purity of the raw material, mix used in the arc furnace, processing and handling techniques used in the MG silicon plant. In all cases very effective segregation of impurities was seen and single crystal structure was achieved in ingots after directional solidification by HEM; the amount of single crystal material varied with the source of meltstock and processing parameters in the furnace. The HEM furnace was used to melt and hold the material for in situ refinement prior to directional solidification. The effect of vacuum, slagging, stirring of the melt, moist argon blowing through the melt and double solidification were studied on the refinement of MG silicon. The sensitivity of these processing techniques was evaluated as a function of time and temperature in some cases. The moist argon blowing and double solidification were found to be the most effective processing techniques to reduce impurities. It is possible to combine slagging and moist argon blowing to achieve more effective purification. It was shown that 7.2% efficient diffused solar cells and 11.84% epitaxial cells can be fabricated from HEM solidified material using commercially available MG silicon. Shunting of cells was observed in the area of SiC particles and this is

attributed to the high carbon content of the MG silicon. The most serious limitation of using this approach is therefore the carbon content of the MG meltstock. MG silicon from India and South Africa were found to be the best sources of MG silicon for this approach.

32868 **Process studies for enzymatic hydrolysis using high solids slurries of acid pretreated mixed hardwood.** Allen, D.C.; Grethlein, H.E.; Converse, A.O. (Dartmouth Coll., Hanover, NH). *Biotechnology and Bioengineering Symposium;* No. 13, 99-111(1983). (CONF-830567—).

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

Average glucose yields of 87, 75, and 67% have been obtained from 10, 15, and 20% slurries, respectively, following 24-h enzymatic hydrolysis of acid pretreated mixed hardwood with an enzyme:solids ratio of 16.7 IU/g using Rutgers C30 cellulase. After 12 h the yields are only about 10% lower that after 24 h. When the enzyme:solids ratio is decreased to 8.3 IU/g, the glucose yields is 74, 59, and 50% for 10, 15, and 20% solids, respectively, in 24 h. The glucose yields achieved following acid pretreatment in a plug flow reactor are significantly higher than those reported in the literature at these high slurry concentrations. 20 references, 1 figure, 6 tables.

32869 **Testing of batteries for solar applications.** Bush, D.M.; Verardo, A.E.; Butler, P.C.; Miller, D.W. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 25-27(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32870 **Development of a sealed, starved electrolyte lead-acid battery for photovoltaic applications.** Szymborski, J.; Eggers, M.L. (Gould Laboratories, Rolling Meadows, Il). *Proceedings - Electrochemical Society;* **81-82**: 140-141(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32871 **Charging characteristics of a sealed, starved electrolyte lead-acid cell designed for photovoltaic applications.** Misra, S.S.; Ogata, K.K. (Gould Laboratories, Rolling Meadows, IL). *Proceedings - Electrochemical Society;* **81-82**: 142-143(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32872 **Plasma modification of grain boundaries in polycrystalline silicon.** Ginley, D.S.; Haaland, D.M.; Seager, C.H. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 699-700(1981). (CONF-811013—Vol.81-82-Absts).

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32873 **Measurement and use of the plasma current waveform in an RF silane discharge.** Mosburg, E.; Kerns, R.; Abelson, J. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 727-728(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32874 **Analysis of silane glow discharges by mass spectroscopy.** Weakliem, H.A. (RCA Laboratories, Princeton, NJ). *Proceedings - Electrochemical Society;* **81-82**: 729-730(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32875 **Preparation, characterization and reaction in oxygen of Cu_2S films.** Czanderna, A.W.; Prince, E.T.; Helbig, H.F. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 850-851(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32876 **Use of SIMS to measure dopant profile changes in semiconductor materials caused by pulsed laser annealing.** Christie, W.H.; Eby, R.E.; Lowndes, D.H.; Young, R.T.; Wood, R.F.; White, C.W. (Oak Ridge National Lab., TN). *Proceedings - Electrochemical Society;* **81-82**: 883-884(1981). (CONF-811013—Vol.81-82-Absts). Contract W-7405-ENG-26.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32877 **Electrowinning of silicon using a molten tin cathode.** Olson, J.M., Kibbler, A. (Solar Energy Reserach Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 1130-1131(1981). (CONF-811013—Vol.81-82-Absts).

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32878 **Low cost silicon by thermite reactions.** Kapur, V.K.; Schmidt, F.A.; Rehbein, D.K. (ARCO Solar, Inc., Chatsworth, CA). *Proceedings - Electrochemical Society;* **81-82**: 1132(1981). (CONF-811013—Vol.81-82-Absts).

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32879 **Refinement of MG silicon by HEM for photovoltaic applications.** Khattak, C.P.; Schmid, F. (Crystal Systems, Inc., Salem, MA). *Proceedings - Electrochemical Society;* **81-82**: 1137-1138(1981). (CONF-811013—Vol.81-82-Absts).

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32880 **Electrorefining of metallurgical grade silicon.** Olson, J.M.; Carleton, K. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 1149-1151(1981). (CONF-811013—Vol.81-82-Absts).

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32884 **Characterization of semiconductor powders by electrochemical techniques.** Bard, A.J.; Pruiksma, R.; White, J.; Dunn, W. (Univ. of Texas, Austin). *Proceedings - Electrochemical Society;* **81-82**: 1163-1164(1981). (CONF-811013—Vol.81-82-Absts).

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32886 **New stability measurements on GaP and WSe_2 photoelectrodes.** Ginley, D.S.; Haaland, D.M.; Biefeld, R.M.; Parkinson, B.A. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 1190-1191(1981). (CONF-811013—Vol.81-82-Absts).

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32887 **Order and disorder in electrodeposited polycrystalline CdSe liquid junction solar cells.** Tomkiewicz, M.; Lyden, J.K. (Brooklyn Coll. of CUNY, NY). *Proceedings - Electrochemical Society;* **81-82**: 1207(1981). (CONF-811013—Vol.81-82-Absts).

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32888 **Solar chemical converter for a solar energy system with storage.** Trachtenberg, I.; Luttmer, J.D.; Yang, J.Y. (Texas Instruments Inc., Dallas). *Proceedings - Electrochemical Society;* **81-82**: 1215-1217(1981). (CONF-811013—Vol.81-82-Absts). Contract FC01-79ER10000.

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32893 **Role of carrier diffusion on the spectral response and efficiency of photoelectrochemical cells with layered semiconductor photoelectrodes.** Kam, K.K.; Parkinson, B. (Iowa State Univ., Ames). *Proceedings - Electrochemical Society;* **81-82**: 1324(1981). (CONF-811013—Vol.81-82-Absts).

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32895 **Surface treatment induced sub-band gap photoresponse.** Butler, M.A.; Arnold, G.W. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 1346-1347(1981). (CONF-811013—Vol.81-82-Absts). Contract AC04-76DP00789.

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32896 **Fermi level pinning at semiconductor electrodes.** Bard, A.J.; Fan, F.R.F.; Nagasubramanian, G. (Univ. of Texas, Austin). *Proceedings - Electrochemical Society;* **81-82**: 1353-1354(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32897 **Photoelectrochemical cells based on n-GaAs and the Cu(II)/Cu(I) redox couple in acetonitrile.** Langmuir, M.E.; Parker, M.A.; Rauh, R.D. (EIC Laboratories, Inc., Newton, MA). *Proceedings - Electrochemical Society;* **81-82**: 1360-1363(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32898 **Photoelectrochemical and thermodynamic behavior of the n-TiO_2 electrode in fluoride solutions.** Hepel, M.; Hepel, T.; Osteryoung, R.A. (State Univ. of New York, Buffalo). *Proceedings - Electrochemical Society;* **81-82**: 1364-1366(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32899 **Photoelectrolysis and hole injection at Fe_2O_3/TiO_2 heterojunction electrode.** Liou, F.T.; Yang, C.Y.; Levine, S.N.; Hakim, K. (Brookhaven National Lab., Upton, NY). *Proceedings - Electrochemical Society;* **81-82**: 1371-1372(1981). (CONF-811013—Vol.81-82-Absts). Contract AC02-76CH00016.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32900 **Substituent effects on ferrocenes in the aluminum chloride-butyl pyridinium chloride molten salt.** Phillips, J.; Fowler, J.S.; Gibbard, H.F. (Gould Inc., Rolling Meadows, IL). *Proceedings - Electrochemical Society;* **81-82**: 1408-1409(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 32863, 32914, 32935

32901 **(BMFT-FB-W—84-010) Study report on a modular photovoltaic power supply system for space application.** Baune, M.; Bittner, H.; Eggers, G.; Goergens, B.; Huettmann, H.J.; Huse, K.; Mansholdt, U.; Roth, M.; Schneider, K.; Westphal, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); ERNO Raumfahrttechnik G.m.b.H., Bremen (Germany, F.R.)). Mar 1984. 9p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751768.

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A modular photovoltaic power supply system is being defined, with a power output of approximately 10 to 30 KW for space application in the coming decades up to the year 2000. The report comprises the probable scenario for application, the system requirements derived, the system and generator definition including electrical and mechanical aspects, the analysis of the dynamic behaviour, control and stabilization of the large array, blanked design and problem areas, power conditioning and energie storage, the spectrum of possible applications, the development and cost planning.

32902 **(DOE/ET/20630—T1) Intermediate Photovoltaic System Application Experiment. Oklahoma Center for Science and Arts. Phase II. Final report.** (Science Applications, Inc., McLean, VA (USA)). Jan 1984. Contract AC04-79ET20630. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84012791.

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This report presents the key results of the Phase II efforts for the Intermediate PV System Applications Experiment at the Oklahoma Center for Science and Arts (OCSA). This phase of the project involved fabrication, installation and integration of a nominal 140 kW flat panel PV system made up of large, square polycrystalline-silicon solar cell modules, each nominally 61 cm x 122 cm in size. The output of the PV modules, supplied by Solarex Corporation, was augmented, 1.35 to 1 at peak, by a row of glass reflectors, appropriately tilted northward. The PV system interfaces with the Oklahoma Gas and Electric Utility at the OCSA main switchgear. Any excess power generated by the system is fed into the utility under a one to one buyback arrangement. Except for a shortfall in the system output, presently suspected to be due to the poor performance of the modules, no serious problems were encountered. Certain value engineering changes implemented during construction and early operational failure events associated with the power conditioning system are also described. The system is currently undergoing extended testing and evaluation.

32903 **(NASA/CR—3338-Vol.1) Solid state SPS microwave generation and transmission study. Volume I. Phase II final report.** Maynard, O.E. (Raytheon Co., Wayland, MA (USA)). Nov 1980. Contract AI01-79ER10035. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84012300.

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The purpose of this investigation was to further define the solid state sandwich concept for SPS. The design effort concentrated on the spacetenna, but did include some system analysis for parametric comparison reasons. The study specifically included definition and math modeling of basic solid state microwave devices, an initial conceptual subsystems and system design, sidelobe control and system selection, an assessment of selected system concept and parametric solid state microwave power transmission system data relevant to the SPS concept. Although device efficiency was not a goal of this study, the sensitivities to design of this efficiency were parametrically treated. Sidelobe control consisted of various single step tapers, multistep tapers and Gaussian tapers. A preliminary assessment of a hybrid concept using tubes and solid state is also included. There is a considerable amount of thermal analysis provided with emphasis on sensitivities to waste heat radiator form factor, emissivity, absorptivity, amplifier efficiency, material and junction temperature. The document is organized to provide useful design data for future studies, identify issues associated with the solid state sandwich design, and estimate technology requirements.

32904 **(PB—84-163575) Power conditioning for a 1 kw photovoltaic power supply. Final report.** Jalade, J.; Marpinard, J.C.; Valentin, M. (Commission of the European Communities, Luxembourg). 1982. 133p. (In French). (EUR—8209-FR). NTIS, PC E07/MF E07.

Changing weather conditions, fluctuating energy demand, and the need for energy storage are considered to be the main problems to be met in the design of a photovoltaic power supply. Each problem is analyzed and an optimum solution proposed, in which, under maximum insolation, surplus energy is stored in batteries for use during less favorable conditions. The main part of the report is concerned with the simulation of such a solar power supply by employing a hybrid system which takes advantage of the complementary features of the MITRA 15 digital and the EAI680 analog computers. The sensitivity of the design to variations in the main parameters is tested.

32905 **(PB—84-164557) Demonstration of a photovoltaic electricity supply of 5 kW peak power and its application to a domestic dwelling. Final report.** Belluque, J.; Naaijer, G.J. (Commission of the European Communities, Luxembourg). 1982. 49p. (In French). (EUR—8152-FR). NTIS, PC E03/MF E03.

The aim is to design an energy conditioning system for a solar house powered by a 5 kW photocell array, a prototype of which is to be installed at Sophia Antipolis by OMERA. The LEP study had several concrete positive results leading to the concept of a homogeneous overall system and the installation of an economic 'all AC' electrical distribution network.

32906 **(PB—84-165661) Free-standing 5kW photovoltaic generator at Refuge des Evettes: conception, analysis of the system, implementation, and testing. Final report Sep 79-Aug 80.** Aubert, B. (Commission of the European Communities, Luxembourg). 1982. 53p. (In French). (EUR—8204-FR). NTIS, PC E04/MF E04.

By September 1979, the photovoltaic generator had been assembled on site. Examination showed that the photovoltaic panels were not damaged by snow during the winter and that the storage battery had withstood the freezing temperatures. The generator was put into use in June 1980. The project provides quantitative results on the amount of solar energy produced.

32907 **(SAND—83-7018) Dynamic simulation of dispersed grid-connected photovoltaic power systems: Task 1 - modelling and control.** Carroll, D.P.; Gareis, G.E.; Krause, P.C.; Ong, C.M.; Schwartz, R.J.; Wasynczuk, O. (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering). Nov 1983. Contract AC04-76DP00789. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013631.

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For purposes of analysis and investigation, four power conditioning subsystems were selected as representative of photovoltaic systems. Two of these systems were single phase arrangements with power levels (5 to 10 kW) in the range of residential applications. The other two were three phase systems representative of power levels of 250 kW to several megawatts. Each system included an array, an inverter with control circuitry, and harmonic filters. Each system was assumed to be connected to a simplified equivalent of a power system. The first objective was to provide detailed representations of each of the four systems by simulating each of the systems on the hybrid computer at Purdue. The array was simulated using an aggregate model determined from digital computer studies of series and parallel strings of non-identical cells. These aggregation studies revealed that the Turfler aggregate model was sufficient to provide an adequate representation of a large array. The converters were simulated in enough detail to portray the switching of each valve within the converter. The primary control (cosine comparator for phase locked oscillator) was also simulated in detail. The secondary control for each converter was a voltage control. Computer traces are given that show the steady-state performance of each of the converter systems. Next, the peak power tracking controls were incorporated into the simulation. These controls

adjust the array voltage so that maximum power conversion is achieved for the given atmospheric conditions. A new method employing an incremental conductance measurement in the peak power tracking was developed. The start-up characteristics and the response of the converter systems during cloud cover transients were investigated using pilot cells and the incremental conductance methods. The systems responded in a satisfactory manner with no indication of instability due to control interaction.

32908 **(SAND—84-0874C-Draft) Photovoltaic system overview.** Sutton, P.D.; Jones, G.J. (Bechtel Power Corp., Los Angeles, CA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 25p. (CONF-840804—2-Draft). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010599.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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This paper provides a brief overview of utility-connected photovoltaic energy systems. It begins by discussing the major elements of the photovoltaic system: the collector, the array field and the power conditioner. Each of these elements is described and the current status of technology development for each is reviewed. We then discuss how these elements are interconnected and the impact of subsystem efficiency on system output. Finally we discuss the issues of system cost and system energy value. The photovoltaic systems are shown to be simple, well defined energy sources with a large potential but geographically limited market.

32909 **(SAND—84-0896C) Future for residential photovoltaic systems.** Thomas, M.G.; Royal, G.C. (Sandia National Labs., Albuquerque, NM (USA); AIA Foundation, Washington, DC (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-840804—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011483.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Residential photovoltaic systems represent a huge potential market. Residential loads represent about one-third of the electrical use in the United States. With the anticipated reduction in module costs to the $2.00/W/sub p/ level, and a building block approach described in this paper, no technical impediments remain for residential photovoltaics. Public acceptance of this alternate is, however, still an open question.

32910 **(SAND—84-1091C) Power conditioning for grid-connected PV systems less than 250 kW.** Key, T.S. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840804—21). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013058.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Power conditioning development for grid-connected photovoltaic (PV) applications has been underway for the past five years at Sandia Laboratories. Although the dc source is a photovoltaic array, many of the advances and lessons learned have general applicability to any dispersed generation source connected to the electric utility grid. Progress in single phase (2 to 10 kW) and three phase (20 to 250 kW) hardware will be covered. Results from a detailed hardware evaluation program will be reviewed. Cost and efficiency experience and future projections will be summarized.

32911 **(SERI/TR—254-1903) Photovoltaic systems for residential applications: a survey of recent literature.** Sillman, S.; Weber, K.; Koontz, R.; Christensen, C.; Hawkins, D. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1984. Contract AC02-83CH10093. 238p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84004502.

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In recent years extensive research has been conducted in the development of residential photovoltaic systems. In this report ninety recent major publications documenting this research were selected and summarized. These selections, which include comprehensive reports as well as recent conference papers and journal articles, are a subset of the comprehensive bibliography of publications on residential PV design found in the appendix of this report. The selected publications are organized into eight topical sections ranging from simulation and design guides to utility-based value. Each individual summary consists of three sections: an overview, a list of major assumptions, and the report conclusions. This organization serves not only to guide the researcher seeking information on specific topics, but also allows the quick comparison of major assumptions and results of different studies.

1407 Solar Thermal Power Systems

32912 **(BMFT-FB-T—84-024) Kuwait, phase 3/stage 1 'Application and test program for the Sulaibyah food/water/power system'.** Zewen, H.; Schmidt, G.; Oechslein, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Messerschmitt-Boelkow-Blohm G.m.b.H., Muenchen (Germany, F.R.). Unternehmensbereich Raumfahrt, Antriebe und Energietechnik). Jan 1984. 91p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751423.

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Objectives are operational tests of the components of a solar thermal power station in the 100 kWe/700 kWth power range as well as the connection of the first electrical users to the power station. The work program includes: a) performance tests of the collector field, the thermal storage, the energy conversion system, and the control of the system; b) operational experiences and results of the solar thermal power station; and c) connection of electrical users to the power station. The performance measurements demonstrated the required mechanical and electrical readiness of the power station. The following operational test phase covered a period of approximately 2 years. The other components belonging to the research program, e.g. the weather-station and the data acquisition system were delivered and installed on time and are working properly. Additional electrical users are a brackish water submersible pump set, as well as a reserve osmosis desalination unit. The Kuwait partner (KISR) has been introduced in the operation of the power station. Since the beginning of 1982, the power station is operated mainly by Kuwait staff members.

32913 **(SAND—84-0313) Bibliography of reports of the Sandia Solar Thermal Distributed Receiver Systems Project.** Leonard, J.A.; Klimas, C.R. (eds.). (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 55p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013208.

This document, which is a bibliography of solar thermal distributed receiver reports and publications by Sandia Laboratories and its contractors, is provided as a convenient reference for those interested in solar thermal technology. Reports are listed by principal author, by report numbers, and by unnumbered reports.

32914 **(SAND—84-0703) Thermal modeling of line focus photovoltaic systems.** Beraun, R. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013920.

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This report addresses the methodology and results of a detailed thermal analysis performed on two photovoltaic systems. System one consists of the Sandia National Laboratories second generation, 92° rim angle, parabolic-cylindrical solar collector as the concentrator developed by the Energy Technology Center of E-Systems Inc. First, a brief description of the systems under investigation and the photovoltaic process is given. Then the methodology and the mathematical algorithm involved in developing the models are presented.

32915 **(SERI/TR—252-2164) Direct-contact condensers for solar pond power production.** Fisher, E.M.; Wright, J.D. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 75p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84004510.

The use of a direct-contact condenser as a way of reducing the cost of electricity from an organic Rankine cycle power plant coupled to a solar pond is examined. Three possible direct-contact heat exchangers are considered: drop-type, bubble-type, and packed-bed. Each condenser is designed to operate with a deaerator and a degasser to reduce contamination and loss of working fluid. Appropriate correlations and models from the literature for heat and mass transfer, particle terminal velocity, and particle production are presented. Each piece of equipment is sized and costed. Finally, the cost of the entire power plant is compared with that of a plant using a conventional shell-and-tube condenser. For two of the three direct-contact designs, a reduction in the cost of electricity is estimated. However, the reduction is not significant enough to compensate for the uncertainties involved in the relatively new technology of direct-contact heat transfer.

32916 **Effects of materials reliability and integrity on the cost of solar energy systems.** Butler, B.L. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 487-488(1981). (CONF-811013—Vol.81-82-Absts). Contract AC02-77CH00178.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32917 **Development of a mid-temperature reference electrode for solar thermal application.** Lanning, B.; Averill, W.; Pohlman, S.; Russell, P. (Colorado School of Mines, Golden). *Proceedings - Electrochemical Society;* **81-82**: 493-494(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32918 **Digital AC impedance system for evaluating materials degradation in solar energy conversion systems.** Hager, J.; Pohlman, S.; Fortune, R.; Russell, P. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 495-496(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32919 **Software development as an integral part of an AC impedance system for corrosion studies.** Fortune, R.; Hager, J.; Pohlman, S.; Russell, P. (Solar Energy Reserach Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 497-498(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32920 **Metals compatibility with molten sodium potassium nitrate salt.** Chihoski, R.A.; Nance, M.; Kiefer, T.F.; Kustas, F.M. (Martin Marietta Aerospace, Denver, CO). *Proceedings - Electrochemical Society;* **81-82**: 503-504(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32921 **Low-cycle fatigue and creep-fatigue behavior of alloy 800 in the presence of saturated and superheated steam.** Kaae, J.L.; Jones, W.B.; VanDenAvyle, J.A.; Munford, J. (General Atomic Co., San Diego, CA). *Proceedings - Electrochemical Society;* **81-82**: 517-518(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32922 **Attack of stainless steel by molten aluminium in a solar concentrator.** Webb, J.; Pohlman, S. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 519-521(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32923 **Degradation of silver/glass solar mirrors.** Lind, M.A.; Hartman, J.S. (Pacific Northwest Laboratories, Richland, WA). *Proceedings - Electrochemical Society;* **81-82**: 526-527(1981). (CONF-811013—Vol.81-82-Absts). Contract AC06-76RL01830.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32924 **Electrochemical evaluation of the degradation of reflector surfaces.** Pohlman, S.; Russell, P. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 528-529(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32925 **Cleaning of float glass and how it effects the corrosion of finished mirrors.** Goggin, R.; Russell, P.; Pohlman, S. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 530-531(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32926 **Experimental approach to evaluating environmental degradation mechanisms in metallized polymeric films.** Webb, J.D.; Schissel, P.; Czanderna, A.W.; Smith, D.M.; Chughtai, A.R. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 533-534(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32927 **Optical properties, thermal stability, and characterization of black cobalt oxide films.** Parks, J.; Call, P. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 549-550(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32928 **Corrosion of 316ss and incoloy 800 in molten (NaK)NO_3.** Bradshaw, R.W. (Sandia National Laboratories, Livermore, CA). *Proceedings - Electrochemical Society;* **81-82**: 505-506(1981). (CONF-811013—Vol.81-82-Absts). Contract AC04-76DP00789.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

1408 Ocean Energy Systems

32929 **(CONF-840816—11) Biofouling control for marine heat exchangers using intermittent chlorination.** Panchal, C.; Larsen-Basse, J.; Little, B. (Argonne National Lab., IL (USA); Hawaii Univ., Manoa (USA). Dept. of Mechanical Engineering; Naval Ocean Research and Development Activity, NSTL, MS (USA)). 5 Aug 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011738.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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Biofouling control for marine heat exchangers is being investigated at the Natural Energy Laboratory of Hawaii (NELH) to determine the effectiveness of low levels of chlorination in the range of 25 to 70 ppb. Two series of tests were conducted using warm surface seawater: (a) intermittent chlorination for the prevention of biofilm formation, and (b) intermittent and continuous chlorination for the removal of an established biofilm from heat exchangers exposed to flowing seawater. A relationship between the rate of removal of biofilm and chlorine consumption has been established. Tests using deep, cold water showed negligible biofouling for an extended period of time, and therefore no chlorination was needed

to control of biofouling. Corrosion-resistant materials (titanium and AL-6X stainless steel) were used in these experiments.

32930 **(PB—84-185230) Shelf mounted Ocean Thermal Energy Conversion platform (revised preliminary report).** (CBI Industries, Inc., Oak Brook, IL (USA)). Mar 1984. 39p. NTIS, PC A03/MF A01.

This report relates model tests of a generic Ocean Thermal Energy Conversion (OTEC) platform. The objective of these tests is to aid in the evaluation of new OTEC designs and to present a data base for design purposes. The test plan has been designed to provide a data base for design purposes. The test plan has been designed to provide a data base for comparison with current and projected analytical tools as well as comparisons of results from one model configuration to another. The new conceptual OTEC designs are different from the typical offshore (jacket type) structure which is quite transparent to waves. The major difference is the addition of large submerged power production modules to the frame. These proposed modules offer a large surface area to obstruct the flow and thereby increase the global wave forces acting on the structure. Three parameters can be identified to characterize the effect that the obstruction has on the hydrodynamical forces. They are the amount of blockage present, the location of the blockage and the manner in which blockage is realized.

32931 **Electrochemical investigation of aluminum for use as a heat exchanger material for an ocean thermal energy conversion (OTEC) system.** Russell, P.; Pohlman, S. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 541-542(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 32952, 33540

32932 **(BFR-R—40-1983) Solar collectors and heat store in a system using air as the energy carrier.** Ottosson, H. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 107p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751015.

The objective of this project has been to develop an airborne space heating system for detached houses, based on solar collectors and a heat storage. It was felt that the incorporation of a high standard of thermal insulation would enable space heating requirements to be met by the ordinary ventilaion system if the air flow was increased somewhat. Project work included development of simple air-cooled solar collectors and a suitable heat storage. The principle of using the ventilation system as a heating system operated satisfactorily, and no direct problems with cold down-draughts or draughts were encountered. In terms of efficiency, the design of the solar collector was comparable with an equivalent water-cooled collector. The collectors tested exhibited long annual utilization times, due partly to the lower thermal capacity of air as opposed to that of water. The design of the stone heat storage was less satisfactory in terms both of the living environment and of cost. Project work was therefore concentrated instead on a latent heat storage, using calcium chloride as the storage medium. Technical performance of this storage was good. Excessive marginal costs prevented this project from being developed to reach the commercial stage. As long as direct electric heating is competitive application of this particular method of heating for detached houses appears to be uneconomic.

32933 **(DOE/CE/15140—T1) Technical evaluation of a solar heating system having conventional hydronic solar collectors and a radiant panel slab. Final report.** Starr, R.J. (Solar Option One Co., Lyndonville, VT (USA)). Apr 1984. Contract FG01-82CE15140. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009556.

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A simple innovative solar heating design (Solar Option One) using conventional hydronic solar collectors and a radiant panel slab was constructed. An objective of hybrid solar design is to combine the relative advantages of active and passive design approaches while minimizing their respective disadvantages. A test house using the Solar Option One heating system was experimentally monitored to determine its energy based performance during the 1982-83 heating season. The test residence is located in Lyndonville, Vermont, an area which has a characteristically cold and cloudy climate. The two story residence has a floor area of about 1400 square feet and is constructed on a 720 square foot 5.5 inch thick floor slab. A 24 inch packed gravel bed is located beneath the slab and the slab-gravel bed is insulated by two inches of polystyrene insulation. The test building is of frame construction and uses insulation levels which have become commonplace throughout the country. The structure would not fall into the superinsulated category but was tightly constructed so as to have a low infiltration level. The building is sun-tempered in that windows were concentrated somewhat on the South side and all but avoided on the North. A solar greenhouse on the South side of the building was closed off from the structure permanently throughout the testing so as to better observe the solar heating invention without confounding variables. The monitoring equipment generated an internal gain of about 17,000 BTUs per day, roughly the equivalent of occupancy by two persons. A full description of the experimental testing program is given. System efficiency and performance are reported.

32934 **(DOE/CS/23986—T1) North Carolina energy conservation plan. Final program report.** (Northampton County Board of Education, Jackson, NC (USA)). 1984. Contract FG01-80CS23986. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013287.

The Energy Conservation Project's objective was to alert and bring the schools and communities together to conserve energy, making them aware of the energy crisis as well as involve them in energy conservation techniques through surveys, materials, supplies, reviews, energy trends and activities such as live projects in construction of solar panels, cookers, handbooks, workshops, etc. Areas of energy waste were pointed out and dealt with. The project also suggested ways and means of providing for the utilization of natural resources to reduce cost of heating, cooling, lighting and water. The project served to eliminate a large quantity of energy for the schools and communities; students and teachers by participation in the program. The objectives of the project were accomplished and the lack of knowledge of the energy crisis is no longer a myth. The LEA supplemented the project funds in the purchasing of materials, supplies, secretarial assistance, workshops, energy conferences, printing, and consultants fees. The project was a success.

32935 **(DOE/CS/30205—T2) Hybrid solar thermal-photovoltaic systems demonstration, Phase I and II. Final technical progress report, July 5, 1979-December 1982.** Loferski, J.J. (ed.). (Brown Univ., Providence, RI (USA). Div. of Engineering). Dec 1983. Contract AC03-79CS30205. 285p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84011814.

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The purpose of the project is to investigate a system based on combined photovoltaic/thermal (PV/T) panels to supply the energy needs of a small single family residence. The system finally selected and constructed uses PV/T panels which utilize air as the heat transfer medium. Optimization of thermal performance was accomplished by attaching metal fins to the back surface of each cell which significantly increased the heat transfer coefficient from the solar cells to the air stream. The other major components of the selected system are an air-to-air heat pump, a rock bin thermal energy storage bin, a synchronous dc-to-ac converter, a microprocessor to control the system, a heat exchanger for the domestic hot water system and of course the building itself which is a one story, well insulated structure having a floor area of 1200 ft^2. A prototype collector was constructed and tested. Based on this experience, twenty collectors, containing 2860 four inch diameter solar cells, were constructed and installed on the building. Performance of the system was simulated using a TRNSYS-derived program, modified to accommodate PV/T panels and to include the particular components included in the selected system. Simulation of the

performance showed that about 65 percent of the total annual energy needs of the building would be provided by the PV/T system. Of this total, about one half is produced at a time when it can be used in the building and one half must be sold back to the utility.

32936 **(DOE/CS/30397—T1) Performance evaluation of the Shenandoah Community Solar Recreational Center for the year 1980. Final report.** Craig, J.I.; Jeter, S.M. (Georgia Inst. of Tech., Atlanta (USA)). Dec 1983. Contract AS05-79CS30397. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013274.

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The Shenandoah Solar Recreational Center, when completed in early 1977, was the largest building to have most of its heating, air conditioning, and hot water needs met by solar energy. Principal components of the building solar energy system are a 1121 sq-m array of modularized flat plate collectors with 2300 sq-m of aluminum foreground reflectors integrated into a sawtooth wood truss roof, a 15.1 cu-m collector loop buffer tank, a 56.8 cu-m hot water storage tank, two 113.6 cu-m chilled water storage tanks, and a nominal 100 ton single stage absorption chiller. The system is interconnected by means of primary-secondary loops and was designed for simultaneous operation of all subsystems in either the heating or cooling modes. Control is by means of conventional HVAC pneumatic and electric control equipment. Transient thermal simulation studies were used to design the solar energy system. The collector array size was fixed so as to provide a significant fraction of the building annual thermal load, and the hot and chilled water storage volumes and other system functions were sized to maximize economic benefit. On this basis the predicted solar fractions were 95% space heating, 64% space cooling and 50% hot water. The building operation was monitored for a period on one year (February 1980 through February 1981) using a calculator-based data acquisition system with 80 sensors located throughout the building. This report presents an analysis of this data and an evaluation of the building performance over the year. The annual collector efficiency was found to be 19% and the overall annual solar fraction (combined thermal loads met from solar) was determined to be 39%. It is felt that this level of performance for a demonstration system is quite acceptable.

32937 **(DOE/CS/32396—T1) Radian solar heating and cooling demonstration project. Final report.** (Radian Corp., Austin, TX (USA)). Apr 1980. Contract AC01-76CS32396. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013289.

A solar heating and cooling system was designed and installed for part of the Radian Corporation office complex in Austin, Texas. The major components of this system include 36 Northrup collectors, a 1500 gal. thermal storage tank, an ARKLA absorption cooling unit and cooling tower, a Servel heating coil, pumps, heat exchanger, and a conventional back-up heating and air conditioning unit. The design and operation of the system are presented. The cost of the major components and the cost of installing the system are presented.

32938 **(DOE/R7/01142—T1) Code complying solar greenhouse designs for Region VII environments. Final report.** (Solar Greenhouse Association, Webster Groves, MO (USA)). 31 Mar 1983. Contract FG47-80R701142. 54p. NTIS, PC A04; 3; GPO Dep. Order Number DE84007855.

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Experiences designing, building, demonstrating, and operating prototype code conforming solar greenhouses suitable to urban environments characteristic of those in the US DOE Region VII are reported. Five conceptual solar greenhouse designs were developed as most applicable to the likely objectives, sites and buildings of urban homeowners and as suitable to the demonstration of appropriate principles, materials, and techniques. Some of this development was based upon a comprehensive survey of all of the residential neighborhoods in the City of Saint Louis undertaken just prior to this program. That study had concluded that: better than 25% of the existing single family homes in St. Louis have sites and orientations suitable to the incorporation of a classic lean-to solar greenhouse or similar solar improvement. In another 10% useful solar access is limited to approaches confined within some part of the existing building envelope other than the front face. Almost another 30% have south facing fronts having good to excellent solar access but building setback restrictions and/or front facade design prohibiting any kind of additional structure. Roof top solar additions are possible for a large number of these. Rooftop solar additions are also possible for another 12% having east or west facing fronts.

32939 **(LA-UR—84-499) Preliminary model for heat transport within a tongue-and-reservoir liquid diode for passive solar heating.** Jones, G.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 33p. (CONF-840816—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007504.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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A preliminary model is presented for heat transport within a tongue-and-reservoir liquid diode for passive solar heating. The diode consists of a rectangular vertical slot (tongue) extending from the bottom of a rectangular-shaped reservoir at the reservoir's front face. Water is used as the working fluid in the tongue and reservoir. Solar radiation is incident on the front face of the tongue, which also loses heat to the outside, while radiation and convection transport heat from the back of the reservoir to the building. Convection transports heat when the tongue is irradiated; however, when convection ceases and the temperature of the tongue cools below that of the reservoir (from exposure to the outside temperature), the reservoir stratifies, and the primary heat loss mechanism is conduction through the tongue and its fluid. The result is a passive solar component that may outperform most others. Flow in the tongue is treated as boundary layer flow; the integral forms of the governing equations are combined to form a single equation governing the local boundary layer thickness. The results are shown to depend upon the Grashof, Prandtl, and heat-loss Biot numbers. Results from this model agree well with those from our flow visualization experiments. A model is also proposed for diode heat transport processes during cool-down. In this model, and empirical coefficient accounts for the weak convective mixing that occurs in the reservoir during this phase. Preliminary results indicate the coefficient to be spatially dependent but independent of time and reservoir temperature. More experiments are planned to further validate both of the models described above.

32940 **(NP—4770327) Contribution to the optimum design of a solar heating system for a residential building.** Arafa, A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Thermodynamik und Waermetechnik). 29 Jun 1982. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770327.

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A model is presented for the simulation of the temporal behaviour of a building equipped with a solar heating system. This model serves to minimise the heat demand by varying several parameters, so as to be able to make an optimised design of a solar heating system. The calculations take into consideration: a three-dimensional temperature field in a flat plate collector, a temperature stratification in the storage tank and the thermal capacity of house walls.

32941 **(PB—84-163682) Solar heating plant for hot running water.** Andreasson, B.; Lagerkvist, K. (Statens Provningsanstalt, Boraes (Sweden)). 1 Dec 1982. 53p. (In Swedish). (SP-RAPP—1983-14). NTIS, PC E04/MF E01.

The project consisted of measuring and evaluation of two solar heating plants for hot running water, one located in Olsfors about one mile southwest of Boras and the other in Vargarda about 5 miles northwest of Boras. Both plants were made in accordance with SBN-75 and other applicable regulations and directives, and were financed entirely with the help of state loans. The plant at Olsfors is owned by the organization Bollebygds Hyresbostader and serves 28 apartments. The apartments have direct operating electric heaters for heating while the hot running water is distributed via conduit from an apparatus room situated in the area's garage structure. The solar heating plant consists of a 108 sq m solar collector

mounted on the roof of the garage and a storage tank with a volume of about 6 cu m placed in the apparatus room. Besides the solar heating system, hot water is heated by an electric heater. The report contains photographs of the plants, schematics, layout diagrams and graphs of measurement results. An analysis of the financing compares the costs of the two plants and their output with the cost of comparable purchased energy.

32942 **(PB—84-173632) Alternate energy sources for ConnDOT's (Connecticut Department of Transportation) materials testing laboratory: feasibility study.** Ganung, G.A. (Connecticut Dept. of Transportation, Wethersfield (USA)). Feb 1983. 41p. NTIS, PC A03/MF A01.

Based on an energy audit of the ConnDOT Rocky Hill Laboratory building, a number of alternate energy sources were investigated, including wind power, photovoltaic energy, heat pumps and solar heating and cooling. Existing alternate energy installations within the State were discussed. Preliminary designs of active and passive solar heating systems were made, and life cycle cost analyses performed. It was determined that, chiefly due to low average wind velocities, wind energy conversion systems were very poor in cost effectiveness. Photovoltaics and heat pumps were also poor. Both active and passive solar heating systems broke even within the 20 year payback period. Design data and life cycle cost analysis tables are included in this report. Although the passive system was approximately equal in cost effectiveness to the active, it was considerably less complex, and further study of the passive system was recommended.

32943 **(PB—84-179266) Passive solar-heating retrofit of a maintenance facility: final report. Research report Mar 81-May 83.** Jackson, D.R.; Callahan, J.M. (Connecticut Dept. of Transportation, Wethersfield (USA). Bureau of Planning and Research). Sep 1983. 48p. (R—724-F-83-16). NTIS, PC A03/MF A01.

See also PB83-171009.

This report presents the energy consumption characteristics of a 12,000 sf maintenance facility in Connecticut retrofitted with a 1,500 sf passive-solar Trombe wall, 2-1/2 in. of foam roof insulation and a new control system that allows night/weekend temperature setback. An energy-consumption monitoring system was installed in January 1980 and collected data for one and a half years before the retrofit and two years after the retrofit. Actual energy consumption was very close to that predicted using simple analytical methods. Average oil consumption for the period 1973 to 1980 was 8206 gal/yr. After the solar wall was installed and other energy-conservation measures implemented yearly oil consumption dropped to 2744 gal. and 2120 gal. for the 81/82 and 82/83 heating seasons, respectively.

32944 **(SAND—84-1042C) Testing of modular industrial solar retrofit industrial process steam systems.** Cameron, C.P.; Dudley, V.E. (Sandia National Labs., Albuquerque, NM (USA); EG and G/Washington Analytical Services Center, Inc., Albuquerque, NM (USA)). 13 Jun 1984. Contract AC04-76DP00789. 11p. (CONF-8406111—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012552.

From International Energy Agency workshop on the design and performance of large solar thermal collectors; San Diego, CA, USA (11 Jun 1984).

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Under the Department of Energy's Modular Industrial Solar Retrofit project, five industrial process heat systems incorporating line-focus solar collectors were designed and hardware was installed and tested at Sandia National Laboratories and the Solar Energy Research Institute. System designers and collector manufacturers participating in the project included Acurex Solar Corporation, BDM, Inc., Custom Engineering, Inc., Foster Wheeler Solar Development Corporation, Solar Kinetics, Inc., and Suntec Systems, Inc. This paper describes the testing of the qualification test systems which has been under way since mid-1982. Each qualification test system includes an equipment skid sufficient to support a collector field of 2300 m^2 aperture and one delta-tempeature string of from 175 to 460 m^2 aperture. Each system is capable of producing saturated steam at 1.7 MPa and operates at maximum outlet temperatures of from 250 to 290°C. The test series includes function and safety tests to determine that the systems operate as specified, an unattended operation test of at least two weeks duration, performance tests to allow prediction of annual system performance, and life cycle tests to evaluate component lifetime and maintenance requirements. Since the start of testing, some twenty five modifications have been made to the various systems for the purpose of improving system performance and/or reliability, and appropriate tests of these modifictions have been made or are underway. This paper presents a description of the approach to testing of the MISR systems and selected test results.

32945 **Passive solar construction handbook.** Levy, M.E. Emmaus, PA; Rodale Press (1983). 335p. (DOE/CE/30748—T1). Rodale Press, Emmaus, PA $29.95. Order Number TI84014092. Contract FG02-82CE30748.

The Passive Solar Construction Handbook provides a reference for adapting standard building methods and materials to passive solar applications. The core of the Handbook is a collection of hundreds of illustrated and labeled details and construction notes for the essential passive solar systems that singly or in combination form the basis of every passive solar building. These systems - direct gain, thermal storage wall, attached sunspace, and convective loop - are broken down for more detailed discussion into the major components in each system: collector, absorber, storage, distribution, and control. Accompanying case studies show how many of these details have been integrated into existing passive solar houses throughout the United States. Extensive cross-referencing leads readers through all appropriate detail options and to specific passive solar materials that are most suitable for each solar application. Specifications and thermal performance information on materials listed aid in final material selection. Introductory sections include passive solar design basics and rules of thumb, an energy-use analysis for choosing and sizing collection systems and components, and an economic analysis for evaluating alternative investment strategies. The appendix contains valuable energy information in chart and table format on the energy performance of specific construction materials. The Load Collector Ratio presented here is a fast technique for estimating the efficiency of an initial design and fine tuning it during the entire design process. The last section of the appendix contains information concerning the availability and uses of common solar analysis tools: computer software, manual programs, models, and handbooks. A glossary of important terms and a bibliography complete the book.

32946 **Five solar-energy desalination systems.** Luft, W. (Solar Energy Research Inst., Golden, CO). *International Journal of Solar Energy;* **1**: No. 1, 21-32(1982).

The cost for desalted water produced by solar energy-powered plants of small capacity, (6000 m^3/day), is at least twice as costly as desalted water produced by conventional plants of comparable size. Five systems for desalting water are described. These are: the Boeing System, the Catalytic System, the Chicago Bridge and Iron System, the DHR System, and the Exxon System. It was found that the total collected energy at system availability per unit product water (kWh/m^3) was lower for the Catalytic System than for any of the others.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 32915

32947 **(DOE/CS/83104—T1) Selective solar absorptance of some oxide and sulfide films grown in-situ on binary metal alloys. Final report.** Douglass, D.L.; Wu, M.Z. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Sep 1982. Contract FG02-80CS83104. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84012775.

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A wide variety of iron-base, nickel-base, and copper-base alloys were subjected to oxidation, sulfidation, and oxidation-sulfidation treatments to form thin surface films with selective optical properties. Films were analyzed by X-ray diffraction, scanning electron microscopy, metallography, and X-ray dispersive energy analysis. Absorptances were determined in both the solar and infrared regions. Oxide films formed on iron alloys had high absorptances,

but the emittances were too high to be of practical interest. Both nickel-base and copper-base alloys formed films which gave interesting combinations of absorptance and emittance. Nickel alloys formed films which had much lower emittances than films on pure nickel for any thickness, although emittance increased with film thickness. Copper alloys formed films having very low emittances and which gave high values (13-16) for the ratio of absorptance to emittance. Sulfidation of the alloys showed that Ni_3S_2 was a poor selective absorber, but Cu_2S had excellent properties. Films containing both sulfides and oxides had excellent selective solar properties, depending upon the phases formed and their relative amounts. The good properties were attributed to either the composite or layer effects. Interpretation of the properties on the basis of band-gap energies was unsuccessful, although the defect structures of the various oxides suggest that oxidation of alloys, allowing incorporation of impurities into the oxide, increased the vacancy concentration and introduced new energy levels.

32948 **(DOE/EIA—0174(83)) Solar collector manufacturing activity 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jun 1984. 56p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. Order Number DE84013067.

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This report presents producer shipments and end-use data from manufacturers of solar thermal collectors and photovoltaic modules. It provides annual data necessary for the Department of Energy to execute its responsibility for (1) monitoring activities and trends in the solar collector manufacturing industry, and (2) providing information on the size and status of the industry to interested groups. These groups include the Solar Energy Research Institute, solar energy specialists, and manufacturers. 3 figures, 13 tables.

32949 **(PB—84-162056) Comparison of collector performance measured in a solar simulator. Final report.** Hettinger, H. (Commission of the European Communities, Luxembourg). 1983. 19p. (EUR—8347-EN). NTIS, PC E03/MF E03.

A study of the efficiency of a solar collector demands that tests are made under both steady state and repeatable operating conditions. This is achieved through the use of a light simulator in a climatic chamber. 38 solar collectors from 13 different manufacturers were examined at the JRC Ispra Establishment (Italy), using the solar simulator LS-1.

32950 **(PB—84-165299) Solar collector test procedures: development of a method to refer measured efficiencies to standardized test conditions. Final report 1977-80.** Thomas, W.C. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mechanical Engineering). Feb 1984. 150p. (VPI-E—80-23). NTIS, PC A07/MF A01.

An analytical procedure has been developed for referring collector efficiency measurements, obtained under different test conditions, to a common, or 'standard' set of conditions. The procedure applies to flat-plate liquid-type collectors of conventional tube-in-sheet design. The basic Hottel-Whillier-Bliss theory is used with appropriate extensions to account for serpentine flow configurations and glazing materials with high infrared transmittance. The procedure includes a systematic method for deriving two invariant collector parameters directly from ASHRAE Standard 93-77 test results. The two parameters selected are the plate absorptance and back loss coefficient. A set of standard conditions is recommended which corresponds to favorable test conditions.

32951 **Tracking system for solar collectors.** Butler, B.L. (to US Dept. of Energy). US Patent 4,425,904. 17 Jan 1984. Filed date 1 Oct 1980. vp.

PAT-APPL-192799.

A tracking system is provided for pivotally mounted spaced-apart solar collectors. A pair of cables is connected to spaced-apart portions of each collector, and a driver displaces the cables, thereby causing the collectors to pivot about their mounting, so as to assume the desired orientation. The collectors may be of the cylindrical type as well as the flat-plate type. Rigid spar-like linkages may be substituted for the cables. Releasable attachments of the cables to the collectors is also described, as is a fine tuning mechanism for precisely aligning each individual collector.

1420 Heat Storage

REFER ALSO TO CITATION(S) 32888, 32932

32952 **(FRNC-TH—1353) Experimental and theoretical comparison of a water storage system and of a phase-change material storage system on the experimental solar building of Bourgoin-Jallieu (Isere).** Aubert-Dasse, C. (Institut National Polytechnique, 38 - Grenoble (France)). Jun 1981. 104p. (In French). NTIS (US Sales Only), PC A06. Order Number DE84751739.

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The aim of this study is to compare on a actual solar building and with a same equipment, the qualities of a water storage system and a phase-change storage system. First, the design of the experiment is present: choice of the material for heat storage, design of the exchanger, realization of the exchanger-storage tank unit and acquisition of the measuring equipment, and operation. Then a computerized simulation of the heat transfers is presented, and the model is adjusted in relation to the actual phenomena. Finally, the experiment results are given, and the influence of some parameters on the system efficiency is studied.

32953 **(LBL—14957) Heat storage in unsaturated soils: initial theoretical analysis of storage design and operational methods.** Doughty, C.; Nir, A.; Tsang, C.F.; Bodvarsson, G.S. (Lawrence Berkeley Lab., CA (USA); Ben-Gurion Univ. of the Negev, Sede Boqer (Israel). Desert Research Inst.). Jun 1983. Contract AC03-76SF00098. 8p. (CONF-830670—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013393.

From International conference on subsurface heat storage in theory and practice; Stockholm, Sweden (6 Jun 1983).

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Unsaturated soil beneath a greenhouse serves as a seasonal storage medium for low temperature heat obtained from solar collectors. The storage configuration consists of an array of vertical helical storage ducts. The computer code PT, developed at Lawrence Berkeley Laboratory, calculates the axisymmetric temperature distribution for a single duct system. Presently heat transfer in the soil is considered to be purely by conduction, but the effect of unsaturated flow will be included in future work. The results of these calculations will guide the construction of an optimal storage system currently being planned.

15 GEOTHERMAL ENERGY

32954 **(PB—84-174481) Development of a geopressured energy management information and analysis system in support of research planning: third year. Annual report Oct 82-Sep 83.** Wrighton, F.M.; Veal, L.K. (Louisiana State Univ., Baton Rouge (USA). Center for Energy Studies). Mar 1984. 66p. NTIS, PC A04/MF A01.

See also PB83-232769.

This annual report presents activities during the third year of research on unconventional gas resources. Geopressured and hydropressured (normally pressured) aquifers containing mobile gas in thin stringers, immobile gas, and gas in solution are known to occur in the Gulf Coast areas of Louisiana and Texas. LSU's role in the development of this resource was to design and implement an energy management information and analysis system to support research planning for the co-production of gas and water concept. This basic research supports GRI's goal of stimulating the commercialization of gas recovery in the near-term. This study has also developed a data base and information system on the problems and potential of unconventional gas resource options in the Gulf Coast and the assessment of each option's potential and remaining problems. During this reporting period, operator cooperation, numeric and analytical simulation techniques, and an improved method of estimating relative permeability were the emphases of research. An assessment of the co-production of gas and water illustrating the technically recoverable gas-in-place in major producing regions of the United States and an evaluation of possible gas production from a hydropressured aquifer were significant studies conducted with

the cooperation of GRI co-production contractors and consultants. Relevant technical information planning was implemented for incorporation into the information system.

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 32967

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 32957, 32961

32955 **(DOE/ID/12026—T5) Thermopolis hydrothermal system with an analysis of Hot Springs State Park.** Hinckley, B.S.; Heasler, H.P.; King, J.K. (Wyoming Univ., Laramie (USA). Dept. of Geology and Geophysics). 1982. Contract FC07-79ID12026. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012701.

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Thermopolis is the site of Hot Springs State Park, where numerous hot springs produce nearly 3000 gallons per minute (gpm) of 130°F (54°C) water. The University of Wyoming Geothermal Resource Assessment Group has studied a 1700-square-mile area centered roughly on the State Park. Available literature, bottomhole temperatures from over 400 oil well logs, 62 oil field drill stem tests, the Wyoming State Engineer's water well files, 60 formation water analyses, thermal logs of 19 holes, and field investigations of geology and hydrology form the basis of this report.

32956 **(DOE/ID/12057—T8) Integration of geothermal data along the Balcones/Ouachita trend, central Texas. Final report.** Woodruff, C.M. Jr.; Gever, C. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1983. Contract AS07-79ID12057. 173p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013412.

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This report presents data that address possible controls on warm-water resources. Data are presented on a series of maps, and interpretations appear in the brief text accompanying the maps. It is thought that structural controls provided by the Balcones Fault Zone on the west and by the Luling-Mexia-Talco Fault Zone on the east localize the warm waters. The ultimate controlling attribute is the foundered Ouachita structural belt, which, in turn, has controlled the orientation and magnitude of displacement of the superjacent normal fault systems. This thesis is supported by maps (in pocket) showing the following: distribution of thermal waters measured in wells along the Balcones/Ouachita structural trend showing water temperature in °F, total depth of the well measured, water salinity in parts per million, and the geologic formation producing the water; structural contours on the base of the Cretaceous System showing the configuration of the Paleozoic Ouachita basement; structural configuration of the Balcones and Luling Fault Zone, Mexia and Talco Fault Zone, and foreland areas adjacent to the Ouachita Orogen using data from the Buda Limestone, Sligo Formation, and Ellenburger Group; Landsat lineaments and Bouguer gravity contours; and geothermal gradient contours of the Balcones/Ouachita trend based on thermal values from Paleozoic and selected Mesozoic formations.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 32955, 32966

32957 **(EUR—8583-EN) High and low enthalpy geothermal resources exploration: Models, strategies and reality.** Sommaruga, C. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1983. 80p. Commission of the European Communities, Luxembourg.

This is a review of the main results of both the R and D and the demonstration projects which are at a more advanced stage - supported by the CEC (Dir. Gen. XII and XVIII of the Commission of the European Communities) since 1 July, 1975. These projects have concentrated on selected test areas, namely the Rhine Graben (Rhine Rift Valley), Massif Central, Naples region, etc. For their implementation is has been necessary to develop suitable prospecting and study technologies and to integrate the various methods of investigation. Also, in the light of the results obtained, we have attempted to provide the projects with defined exploration targets for which we have tried to assess the real prospects. In particular, some geological environments of differing geothermal interest have been identified; these are: crystalline massifs, intracratonic basins, foredeep basins, marginal basins, continental rifts, fissural basic volcanism, anatectic magmatism and central volcanoes with highly evolved products.

32958 **(EUR—8605-EN) Nisyros-1: geothermal well.** Merla, A. (Commission of the European Communities, Luxembourg). 1983. 240p. NTIS, PC E10/MF E10.

The drilling of Nisyros-1 well was decided by PPC late in 1981 on the basis of results of previous extensive exploration. All the geological, geochemical, and engineering data collected during the drilling and during preliminary production testing and fluid sampling are presented. The drilling of the Nisyros-1 deep exploratory well confirmed the dependable geothermal potential of this island.

32959 **(EUR—8790) Temperature and pressure measurement in high enthalpy geothermal wells, possibilities for optical fiber application, prefeasibility study.** Gueguen, F. (Commission of the European Communities, Luxembourg). 1983. 85p. (In French). Commission of the European Communities, Luxembourg. Order Number TI84751738.

The properties of optical fibers are briefly recalled, then the feability study of a transmission system by optical fibers with optical sensors is examined. The measurement system proposed comprises a transmission system with optical fibers of length equal to the well and a pressure and/or temperature sensor with optical fibers. The sensor, electrically passive, is optically interposed between the source and the detector which are both at the surface. Intensity modulators are chosen, rather than interferometers for better sensitivity and with a signal to noise ratio allowing a fairly wide measuring range. The signal emitted by the source is modulated by the sensor which should be as sensitive as possible to pressure or temperature but the transmission system should be insensitive to environment and optical fibers are chosen accordingly and optimized for attenuation and spatial resolution. In conclusion materials should be developed for a better thermal resistance.

32960 **(LA—10067-MS) Well log interpretation of certain geothermal fields in the Imperial Valley, California.** Ershaghi, I.; Abdassah, D. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013853.

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This study reviews the wireline log responses of some geothermal fields in the Imperial Valley, California. The fields under study include the Heber, the East Mesa, the Brawley, and the Westmoreland. The well logs used in the study did not include all the wireline surveys obtained by the operators. The selected well logs obtained under special arrangements with the operators were chosen to maintain the anonymity of specific well locations but are only representative of each area. Analysis of the well logs indicates that on an individual field basis, the well logs are excellent for correlation purposes. The presence of extremely saline fluids in some fields precludes the monitoring of Q/sub v/ (cation exchange capacity per unit volume) profile for detection of hydrothermally altered zones. The producing sections in all the fields are characterized by low porosity and high resistivity.

32961 (LA—10105-OBES) Low-temperature geothermal potential of the Ojo Caliente warm springs area, northern New Mexico. Vuataz, F.D.; Stix, J.; Goff, F.; Pearson, C.F. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013857.

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A detailed geochemical investigation of 17 waters (thermal and cold, mineralized and dilute) was performed in the Ojo Caliente-La Madera area. Two types of thermomineral waters have separate and distinctive geologic, geochemical, and geothermal characteristics. The water from Ojo Caliente Resort emerges with temperatures ≦ 54°C from a Precambrian metarhyolite. Its chemistry, typically Na-HCO_3, has a total mineralization of 3600 mg/l. Isotopic studies have shown that the thermal water emerges from the springs and a hot well without significant mixing with the cold shallow aquifer of the valley alluvium. However, the cold aquifer adjacent to the resort does contain varying amounts of thermal water that originates from the warm spring system. Geothermometry calculations indicate that the thermal water may be as hot as 85°C at depth before its ascent toward surface. Thermodynamic computations on the reaction states of numerous mineral phases suggest that the thermal water will not cause major scaling problems if the hot water is utilized for direct-use geothermal applications. By means of a network of very shallow holes, temperature and electrical conductivity anomalies have been found elsewhere in the valley around Ojo Caliente, and resistivity soundings have confirmed the presence of a plume of thermal water entering the shallow aquifer. The group of lukewarm springs around La Madera, with temperatures ≦ 29°C, chemical type of NaCaMg-HCO_3Cl and with a total mineralization ≦ 1500 mg/l behaves as a different system without any apparent relation to the Ojo Caliente system. Its temperature at depth is not believed to exceed 35 to 40°C.

32962 (LA-UR—84-1639) Logging technology for high-temperature geothermal boreholes. Dennis, B.R. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 10p. (CONF-840572—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012452.

From International symposium on observation of the continental crust through drilling; Tarrytown, NY, USA (20 May 1984).

Research in materials, equipment, and instrument development was required in the Hot Dry Rock Energy Extraction Demonstration at Fenton Hill located in northern New Mexico. Results of this extensive development advanced the logging technology in geothermal boreholes to present state-of-the art. The new Phase II Energy Extraction System at the Fenton Hill Test Site will consist of two wellbores drilled to a depth of about 4570 m (15,000 ft) and then connected by a series of hydraulic-induced fractures. The first borehole (EE-2) was completed in May of 1980 at a depth of 4633 m (15,200 ft) of which approximately 3960 m (13,000 ft) is in Precambrian granitic rock. Starting at a depth of approximately 2930 m (9600 ft), the borehole was inclined up to 35° from vertical. Bottom-hole temperature in EE-2 is 320°C. The EE-3 borehole was then drilled to a depth of 4236 m (13,900 ft). Its inclined part is positioned directly over the EE-2 wellbore with a vertical separation of about 450 m (1500 ft) between them. Many of the geophysical measurements needed to develop the hot dry rock concept are unique. Most of the routine instruments used in petroleum drilling fail in the hot and abrasive environment. New equipment developed includes not only the downhole sonde that houses the transducer and associated line driving electronics, but modifications also were needed on the entire data retrieval systems and associated data analysis technology. Successful performance of wellbore surveys in the EE-2 and EE-3 boreholes depended upon the capacity of the sensors, instrument sonde, cablehead, and armored logging cable to work in this severe environment. The major areas of materials development for surveying the boreholes in the high-temperature environment were on elastomeric seals, electrical insulation for logging cables, downhole sensors, and associated downhole electronic and electro-mechanical components.

32963 (LBL—17644) Long-term dipole-dipole resistivity monitoring at the Cerro Prieto geothermal field. Wilt, M.; Goldstein, N.E.; Sasaki, Y. (Lawrence Berkeley Lab., CA (USA); Kyushu Univ., Fukuoka (Japan). Faculty of Engineering). Apr 1984. Contract AC03-76SF00098. 9p. (CONF-840809—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012251.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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Dipole-dipole resistivity measurements for the combined purposes of reservoir delineation and reservoir monitoring were first made at Cerro Prieto in 1978 and have continued on approximately an annual basis since then. Two 20 km-long dipole-dipole lines with permanently emplaced electrodes at 1-km spacings were established over the field area. Resistivity remeasurements have been made on one line at 6- to 18-month intervals using a 25 kW generator capable of up to 80A output and a microprocessor-controlled signal-averaging receiver. This high-power, low-noise system provides highly accurate measurements even at large transmitter receiver separations. Standard error calculations for collected data indicate errors less than 5% for all points. Results from four years of monitoring (1979-1983) indicate a 5% average annual increase in apparent resistivity over the present production area, and larger decreases in apparent resistivity in the region to the east. The increase in resistivity in the production zone is most likely due to dilution of reservoir fluids with fresher water, as evidenced by a drop in chloride content of produced waters. The area of decreasing resistivity east of the reservoir is associated with a steeply dipping conductive body, a zone of higher thermal gradients and an increase in shale thickness in the section. Decreasing resistivity in this area may be caused by an influx of high temperature, saline water from depths of 3^+ km through a sandy gap in the shales.

32964 (SAND—84-0756C) Feasibility of a borehole VHF radar technique for fracture mapping. Chang, H.T. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 5p. (CONF-840809—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009920.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

Experiments were conducted to establish the feasibility of a downhole high-frequency electromagnetic technique for location of fractures in the vicinity of boreholes. An existing flame-cut slot in granite was filled with salt water to simulate a brine-filled fracture. A transmitter consisting of a phased dual-dipole array arranged to provide a directional signal toward the fracture was installed in a borehole opposite the fracture. A receiver operated at 30 to 300 MHz was also located in the same borehole. The radar returns from the simulated fracture were detectable in boreholes located at distances of up to 12 meters from the fracture. These results indicate for the first time the feasibility of a downhole VHF radar for use in a single borehole for detection of fractures located away from the borehole.

1504 Legal And Institutional Aspects

REFER ALSO TO CITATION(S) 32966

1506 Environmental Aspects And Waste Disposal

32965 (DOE/SF/11664—T3) Direct chlorination process for geothermal power plant off-gas - hydrogen sulfide abatement. Sims, A.V. (Sheinbaum (I.) Co., Inc., Monrovia, CA (USA)). Jun 1983. Contract AC03-82SF11664. 59p. NTIS, PC A; 3; GPO Dep. Order Number DE84011396.

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The Direct Chlorination Process removes hydrogen sulfide from geothermal off-gases by reacting hydrogen sulfide with chlorine in the gas phase. Hydrogen chloride and elemental sulfur are formed by this reaction. The Direct Chlorination Process has been successfully demonstrated by an on-site operation of a pilot plant at the 3 M We HPG-A geothermal power plant in the Puna District

on the island of Hawaii. Over 99.5 percent hydrogen sulfide removal was achieved in a single reaction state. Chlorine gas did not escape the pilot plant, even when 90 percent excess chlorine gas was used. A preliminary economic evaluation of the Direct Chlorination Process indicates that it is very competitive with the Stretford Process. Compared to the Stretford Process, the Direct Chlorination Process requires about one-third the initial capital investment and about one-fourth the net daily expenditure.

32966 **(PB—84-173665) Survey of environmental regulations applying to geothermal exploration, development, and use. Final report.** Beeland, G.V. (Wapora, Inc., Washington, DC (USA)). Mar 1984. 251p. NTIS, PC A12/MF A01.

See also PB-281023.

Federal, State, and local environmental laws and regulations that apply to geothermal energy development are summarized. Most attention is given to those regulations which deal with air pollution, water pollution, solid wastes and impact assessments. Analyses are made of the regulations with respect to resource definition, pollutants currently not controlled, duplicity and overlap in permit and impact assessment requirements, the lack of uniformity of regulations between states, and the probable future approaches to the regulatory problems. This project updates a similar document (EPA/600/7-78-014) dated February 1978.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 32965, 32976

32967 **(DOE/ET/27196—T17) Water for goethermal development in Imperial County. A summarizing report.** (Imperial, County of, El Centro, CA (USA). Dept. of Public Works). Jan 1984. Contract FC03-79ET27196. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013636.

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Information on water issues related to geothermal development is reviewed, including research on local water resources and quality, cooling water requirements for geothermal power plants, and water for geothermal development. Topics of on-going research are noted and questions for future research are posed.

32968 **(DOE/ET/27252—T1) Open loop pneumatic control of a Lysholm engine or turbine exhaust pressure.** Plonski, B.A. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). 17 Jul 1981. Contract AT03-80ET27252. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013595.

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A Lysholm engine, or helical screw expander, is currently being evaluated at the University of California, Berkeley for staging with a conventional turbine in geothermal energy conversion. A pneumatic closed loop, proportional-integral control system was implemented to control the Lysholm engine's exhaust pressure for performance testing of the engine at constant inlet/outlet pressure ratios. The control system will also be used to control the exhaust pressure of the conventional turbine during future testing of the staged Lysholm-turbine system. Analytical modeling of the control system was performed and successful tuning was achieved by applying Ziegler-Nichol's tuning method. Stable control and quick response, of approximately 1 minute, was demonstrated for load and set point changes in desired exhaust pressures.

32969 **(DOE/ET/27252—T2) Hybrid staging of a Lysholm positive displacement engine with two Westinghouse two stage impulse Curtis turbines.** Parker, D.A. (California Univ., Berkeley (USA). Coll. of Engineering). Jun 1982. Contract AT03-80ET27252. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013693.

Portions are illegible in microfiche products; Thesis.

The University of California at Berkeley has tested and modeled satisfactorly a hybrid staged Lysholm engine (positive displacement) with a two stage Curtis wheel turbine. The system operates in a stable manner over its operating range (0/1-3/1 water ratio, 120 psia input). Proposals are made for controlling interstage pressure with a partial admission turbine and volume expansion to control mass flow and pressure ratio for the Lysholm engine.

32970 **(DOE/ET/27252—T3) Altering the volumetric expansion ratio of a Lysholm helical screw expander.** Dunbar, M.K. (California Univ., Berkeley (USA). Coll. of Engineering). 1984. Contract AT03-80ET27252. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013695.

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This is an analysis of the effects of the volumetric expansion ratio on the operation of a Lysholm helical screw expander. Extensive testing of the University of California Lysholm engine with a 5.3 volumetric expansion ratio was performed. In this experiment, the expansion ratio has been reduced from 5.3 to 4.0. Tests were performed at a variety of speeds and qualities for a 5.0 pressure ratio and at a variety of speeds and pressure ratios for 99 percent quality. It was predicted that decreasing the volumetric expansion ratio would decrease the leakage fraction and thereby increase efficiency. This occurred as predicted. Isentropic efficiency increased 20 percent for 50 percent quality steam and 16 percent for 33 percent quality steam, all for an inlet pressure of 120 psia and a speed of 9000 rpm. A maximum efficiency of 47.2 percent was reached at 33 percent quality, 9000 rpm and a pressure ratio of 5.0. It was noted that the leakage rate did not appear to be a function of expansion ratio, as had been expected. Using this fact the previous empirical models of the engine were extended to include volumetric expansion ratio as a variable parameter.

32971 **(DOE/ET/27252—T4) Comparison between two Lysholm engines.** Frau, B.A. (California Univ., Berkeley (USA). Coll. of Engineering). 1983. Contract AT03-80ET27252. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013696.

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The University of California at Berkeley (UCB) and the Jet Propulsion Laboratory (JPL) both have been working on the Lysholm engine as an expander of two phase geothermal brine. The sizes of the machines, (The machine at UCB is rated at 25 kW, and the machine that JPL tested is rated at 1MW) as well as the approaches, are different. Here, some comparisons are made in order to clarify the direction in which future efforts should be conducted.

32972 **(DOE/ET/27252—T5) Analysis and testing the performance of a centrifugal two phase flow separator.** Mirza-Moghadam, A.V. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). Win 1980. Contract AT03-80ET27252. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013598.

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Analysis and testing the performance of an 8 in., 1.72 ft high centrifugal cyclone separator for flows up to 4.0 lbs/s and pressures ranging from 10 to 60 psig. Conclusions drawn are based on inlet steam qualities of 23 to 27 percent (x% = m/sub s//m /sub t/) .99% and better steam quality is achieved up to 3 lbs/s under 50 and 60 psig. Breakdown flow rate is found to be a linear function of separator pressure.

32973 **(DOE/ET/27252—T6) Performance characteristics of the Lysholm engine.** Berger, R.E. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). 1980. Contract AT03-80ET27252. 87p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013596.

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The performance of a 5 in. diameter rotor Lysholm engine prototype running on simulated geothermal flows from 16 to 100% quality is described. Staging was performed with conventional Westinghouse 25 kW steam turbines demonstrating that such a process is feasible. Maximum efficiency and power noted were 37.2% and 26.3 kW respectively, but inhibiting factors were discovered which, upon correction, should allow efficiencies around 50% and powers up to 35 kW. Larger engines with minor modifications should get better efficiencies. Data was taken for inlet pressures of 75 to 120 psia and speeds of 3000 to 9000 rpm's. Further testing under similar conditions is planned.

32974 **(DOE/ET/27252—T8) Empirical modeling of a Lysholm helical screw expander.** Brown, K.A. (California Univ., Berkeley (USA). Coll. of Engineering). 1984. Contract AT03-80ET27252. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013694.

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Testing of a Lysholm helical screw expander having a rotor diameter of 5.12 inches and an expansion ratio of 5.3 was performed with simulated geothermal fluid at an inlet pressure of 120 psia. The inlet quality, engine speed and pressure ratio were independently varied to produce a three-dimensional data matrix of 104 data points. Statistical curve fitting methods were adapted to produce equations for mass flow rate and power output in terms of the three variables associated with the data matrix. These explicit equations were combined with a steam table subroutine to produce a computer model for prediction of mass flow rate, power, efficiency and exhaust quality at a given set of operating conditions. The predictive ability observed during validation of the model is adequate for use in modeling of hybrid geothermal energy conversion systems. Mass flow rates werre predicted to within 2.7% of the measured values. For most conditions, predictions of power were within 3.3% of the measured values. Predictions of efficiency reflected the combined errors in prediction of power and mass flow rate. Efficiency predictions were in error by as much as 5% of the measured values. The predictions for exhaust quality were within 0.4% of the measured values. Isentropic engine efficiencies of over 43% were measured during the tests. An observed peak in efficiency represented an optimum pressure ratio and a trade-off between lower leakage fractions at high speeds and low inlet qualities, increasing frictional losses at high speeds, and increasing fluid and power densities at low qualities.

32975 **(EUR—8791-EN) Feasibility of electricity generation from medium enthalpy (100-200°C) geothermal sources.** Pempie, P.; Potiron, A.; Mauconduit, M.; Grossin, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1983. 185p. Commission of the European Communities, Luxembourg.

This report addresses the technical and economical feasibility of electric power generation from medium to high enthalpy geothermal sources which represent a wide range of resources, many of them unexploited to date. Depending on the conditions prevailing locally - temperatures, pressures, steam or/and brine flow rates, cold source - a suitable cycle and production system will be selected. The report reviews existing and non conventional conversion cycles, processes and engines. Emphasis is placed on calculation of cycle, system and economic efficiencies of the candidate cycles for extracting energy from medium enthalpy geothermal brines.

1509 Geothermal Engineering

32976 **(DOE/ET/27252—T7) Design, construction and evaluation of a simulated geothermal flow system.** Mackanic, J.C. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). 28 Jul 1980. Contract AT03-80ET27252. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013597.

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A system was designed and built to simulate the flow from a geothermal well. The simulated flow will be used to power a Lysholm engine, the performance of which will then be evaluated for different simulated geothermal flows. Two main subjects are covered: 1) the design, construction and evaluation of the behavior of the system that simulates the geothermal flow; included in that topic is a discussion of the probable behavior of the Lysholm engine when it is put into operation, and 2) the investigation of the use of dynamic modeling techniques to determine whether they can provide a suitable means for predicting the behavior of the system.

32977 **(FRNC-TH—1363) Study of phase transformation phenomena by auto-evaporation in a porous medium.** Podaire, A. (Institut National Polytechnique, 31 - Toulouse (France)). Feb 1981. 133p. (In French). NTIS (US Sales Only), PC A07. Order Number DE84750800.

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This study takes interest in the phenomena which arise in the course of the exploitation of "high energy" type geothermal deposits: aquifers of which temperature of waters is above 150°C (high geothermal gradient regions). The bringing in of such reservoirs may produce, in the vicinity of the well, two types of flow, of which existence depends on the thermodynamic conditions of the deposit and on the operating way: a liquid phase flow or a two-phase flow (liquid + vapor). This study is mainly devoted to develop numerical models allowing to get a local description of these phenomena. After a bibliographical synthesis, mainly focused on the simulations of the behavior of reservoirs, the study is devoted to: the presentation of the mathematical model from which the analysis of the phenomena will be done, the brief description of the experimental installation and the presentation of some results, the statement of the method of solution of the mathematical model of which representative character is qualitatively appraised, first of all comparatively to some experimental results and will be used, then to estimate the dependence to some parameters for the evolution of the phenomena.

32978 **(LA-UR—84-1106) Downhole seismic monitoring of an acid treatment in the Beowawe Geothermal Field.** Batra, R.; Albright, J.N.; Bradley, C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-840809—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010002.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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During the acid treatment of a subeconomic well at the Beowawe Geothermal Field, numerous seismic events were detected of which 22 could be located. The events occurred following a first stage of the acid treatment and generally define a trend paralleling the surface trace of the Malpais fault. No seismic signals were detected following a second stage of the acid treatment, despite the injection of almost twice as much additional fluid. It is postulated that the cause of seismic events following the first stage was due to shear failure of chemically weakened cemented fracturs or joints in the reservoir. Presumably reservoir strain was sufficiently reduced to preclude further rock failure during the second day of treatment.

32979 **(LA-UR—84-1193) Hydraulic fracturing and propping tests at Yakedake field in Japan.** Yamaguchi, Tsutomu; Seo, Kunio; Suga, Shoto; Itoh, Toshinobu; Kuriyagawa, Michio. (National Research Inst. for Pollution and Resources, Yatabe, Ibaraki (Japan); Mitsui Mining and Smelting Co. Ltd., Tokyo (Japan); Japan Petroleum Exploration Corp., Musashino, Tokyo). 1984. Contract W-7405-ENG-36. 7p. (CONF-840809—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011350.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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Hydraulic fracturing experiments have been conducted at Yakedake field in Gifu prefecture, Japan. From the data obtained during the fracturing operation, the open-hole section permeability was estimated of the wellbore, the minimum pressure required to propagate the fracture, the impedances before and after the propping, and the earth stress normal to the fracture plane. The final fracture plane was also mapped with the microseismic events.

32980 **(LA-UR—84-1900) Well simulation using Refrigerant 114.** Nikitopoulos, D.E.; Dickinson, D.A.; DiPippo, R.; Maeder, P.F. (Los Alamos National Lab., NM (USA); Brown Univ., Providence, RI (USA)). Jun 1984. Contract W-7405-ENG-36. 6p. (CONF-840809—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013906.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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A simple method for the investigation of thermodynamic (substance) similarity in the two-phase domain is introduced based on the assumptions of a simplified model fluid. According to this

method, the investigation of the conditions for thermodynamic similarity between substances in the two-phase region reveals the important role the latent heat of evaporation (h/sub fg/) plays in the definition of the property scales. These greatly influence the dynamic and geometric similarity of the process under investigation. The introduction of the thermodynamic similarity property scales into the energy conservation equations for a certain process (e.g., flow up a geothermal well) brings forth a thermodynamic length scale and kinetic energy scale. Refrigerant 114 has been examined for similarity with water substance according to this method and found to be adequate for geothermal well simulation in the laboratory. Low pressures and temperatures and a substantial reduction of mass flow rates and geometric scales are a few of the advantages of using R114 for such experiments.

32981 **(LBL—14511) Well test data analysis from a naturally fractured liquid-dominated hydrothermal system.** Benson, S.M. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 7p. (CONF-821007—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013244.

From Annual geothermal resources council meeting; San Diego, CA, USA (11 Oct 1982).

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Production test data from a moderate-temperature geothermal well in the Basin and Range Province have been analyzed. The well is completed in granitic basement rock. Both the pressure transient and spinner data confirm that fractures provide the major component of the reservoir permeability. The productivity index of the well decreases and the apparent skin factor increases with increasing flow rate. This behavior is attributed to non-Darcy flow in the fractures near the well bore. A mathematical relation between flow rate and drawdown has been established that includes the non-Darcy and Darcy flow components.

32982 **(LBL—17694) Numerical studies of enthalpy and CO_2 transients in two-phase wells.** Bodvarsson, G.S. (Lawrence Berkeley Lab., CA (USA)). 1984. Contract AC03-76SF00098. 9p. (CONF-840809—15). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012252.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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Numerical studies of enthalpy and CO_2 transients for wells completed in composite reservoir systems are carried out. Both constant rate and constant pressure production are considered. The results show that relatively small variations in hydrologic parameters and vapor saturation can have large effects on the enthalpy and CO_2 content of the produced fluids. Field data are presented that illustrate the theoretical results obtained.

32983 **(PB—84-167410) Making the most of geothermal power.** Turtle, J. (Central Electricity Generating Board, Southampton (England). Technology Planning and Research Div.). 1982. 31p. (TB—466). NTIS, PC E04/MF E04.

Geothermal energy research is continually striving to obtain more electrical power from a given quantity of fluid extracted from the ground; In this note the contribution arising from optimisation of the heat exchanger differential temperatures is explored using a simple model; The contribution is shown to be significant. A recommendation is made that the impact of these differential temperatures should be evaluated on a more representative computer model to determine the optimum economic cost of geothermal electricity from the Hot-Dry-Rock resource in Cornwall. (Copyright (c) Central Electricity Generating Board 1982.)

32984 **(SAND—84-0314C) GEOGYN - a geological formation/drill string dynamics computer program.** Caskey, B. (Sandia National Labs., Albuquerque, NM (USA)). 16 Sep 1984. Contract AC04-76DP00789. 22p. (CONF-8409104—1). NTIS, PC AA02/MF A01; 1; GPO Dep. Order Number DE84013808.

From 59. annual Society of Petroleum Engineers of AIME technical conference; Houston, TX, USA (16 Sep 1984).

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This paper describes the initial development phase of a finite element computer program, GEODYN, capable of simulating the three-dimensional transient, dynamic response of a polycrystalline diamond compact (PDC) bit interacting with a non-uniform formation. The ability of GEODYN to simulate response variations attributable to hole size, hole bottom surface shapes, and formation material non-uniformities is demonstrated. Planned developmental phases will address the detailed response of a bottom-hole assembly (BHA), a drill ahead (rock penetration and removal) simulation, and ultimately, the response of the entire string.

32985 **(SAND—84-0757C) Thermal limitations on the use of PDC bits in geothermal drilling.** Glowka, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840809—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010269.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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Factors affecting the potential for using polycrystalline diamond compact (PDC) drill bits in geothermal drilling are discussed. Pertinent results from previous laboratory and field tests are reviewed. The two predominant failure mechanisms, abrasive cutter wear and catastrophic loss of cutters, are discussed. A temperature activated mechanism for accelerating cutter wear is identified, and the implications for hard-rock drilling are investigated. An upper bound on drillable rock strength without causing thermally-accelerated wear is established for a variety of operating and environmental conditions.

32986 **(SAND—84-0758C) Analyzing the dynamic behavior of downhole equipment during drilling.** Baird, J.A.; Caskey, B.C. (Jordan, Apostal, Ritter Associates, Inc., Davisville, RI (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 5p. (CONF-840809—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008840.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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Advanced geothermal drilling systems will require a bottom hole assembly (BHA) which utilizes sophisticated electronic and mechanical equipment to accomplish faster, more trouble free, smarter drilling. The bit-drill string/formation interaction during drilling imposes complex, intermittent dynamic loading on the downhole equipment. A finite element computer code, GEODYN, is being developed to allow analysis of the structural response of the downhole equipment during drilling and to simulate the drilling phenomena (i.e. penetration, direction, etc.). Phase 1 GEODYN, completed early in 1984, provides the capability to model the dynamic response of a polycrystalline diamond compact (PDC) bit interacting with a non-homogeneous formation. Succeeding development phases will allow inclusion of stabilizers and, eventually, the entire drill string in addition to facilitating drill ahead simulation.

32987 **(SAND—84-0759C) Program to investigate the engineering feasibility of extracting energy from shallow magma bodies.** Carson, C.C.; Allen, A.D. (Sandia National Labs., Albuquerque, NM (USA); USDOE, Washington, DC). 1984. Contract AC04-76DP00789. 3p. (CONF-840809—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008852.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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A new program, sponsored by the Department of Energy's Geothermal and Hydropower Technologies Division, has begun to investigate the engineering feasibility of extracting energy from shallow magma bodies. This program follows a previous investigation of the scientific feasibility of using magma and differs from it in focus. The current program is directed toward determining whether magma energy can be extracted economically. In the first year of the program, the three most promising sites for a long term experiment will be characterized; the research and development tasks that will be required will be identified; and a program plan outlining the entire feasibility study will be compiled.

1510 Direct Energy Utilization

32988 **(DOE/ID/12137—T1) New Mexico State University Campus geothermal demonstration project.** Cuniff, R.A.; Fisher, K.P.; Chintawongvanich, P. (New Mexico State Univ., Las Cruces (USA). Physical Science Lab.). Apr 1984. Contract FC07-80ID12137. 278p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84013698.

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This report presents the design, construction highlights, and performance of the New Mexico State University Campus Geothermal Demonstration Project at Las Cruces, New Mexico. Construction started in July 1981, first system use was January 1982, and the system was dedicated on April 21, 1982. Included herein are summary observations after two years of use. The geothermal hot water from New Mexico State University wells is used to heat potable water, which in turn provides 83 percent of the domestic hot water on the New Mexico State University campus, as well as space heat to two buildings, and for two heated swimming pools. The original system is providing service to 30 total buildings, with two additional buildings (150,000 square feet) in process of geothermal conversion.) The system overall performance has been excellent, except for geothermal well pump problems. In terms of operating efficiency, the system has exceeded the design parameters. In spite of abnormally high costs for well and pump repairs, the system has shown a positive cost avoidance of more than $118,000 for the first year of operation. For the first two full years of operation, the system has produced a net positive cost avoidance of more than $200,000. Payback on the total investment of $1,670,000 is projected to be 6 to 10 years, depending on the future prices of natural gas and electricity.

32989 **(EUR—8481-FR) Design and testing of a prototype forced-draft, low temperature fan convector.** Thellier, F. (Commission of the European Communities, Luxembourg). 1983. 70p. (In French). NTIS, PC E04/MF E04.

The main requirement for the design of a fan of a convector used in exploitation of a geothermal source was to meet a low noise level. At a turbine speed of 1,000 RPM, a flow rate of 150 sq m/h, and at low water inlet temperatures, the tests showed that the performance of the forced-draft convector was better than that of the natural draft convector. This means that the outlet temperature is lower for the forced draft convector, resulting in a higher heat release of the geothermal source. The advantages of this type of convector are: (a) possible use of low temperature geothermal brines (40 C), and (b) COP values are expected to be 80% higher when coupled to a multistage heat pump than with conventional convectors.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 33233

32990 **(BEOP—24) IEA R and D program for Wind Energy Conversion Systems. Paper presented at the National Wind Energy Conference 1983.** Sens, P.F. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Nov 1983. 20p. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750915.

The IEA research and development program for wind energy conversion systems is surveyed (IEA-R and D-WECS). The original tasks were: study of environmental and meteorological aspects of WECS; evaluation of wind models for site selection; integration of wind power into the national electric power grid, and research on the loads on the rotor blades of large wind turbines. Later on these tasks were extended with: turbulence patterns behind solitary wind turbines and wind turbine parks; local patterns of air currents round a hill, situated in front of a WECS, and offshore WECS. Twelve countries are participating in this project. Large systems are under construction or already in operation to prove that wind is a usable source for large scale electric power generation. The original tasks of this project, mentioned above, are already completed and fully realized.

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 32997

1703 Regulations

32991 **(DOE/CS/60014—3) Zoning for wind machines. A guide for Minnesota communities.** (Minnesota Dept. of Energy and Economic Development, St. Paul (USA). Energy Div.). Aug 1983. Contract FG45-76CS60014. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012315.

The purpose of the guide is to provide information on wind machines and related zoning issues to enable planners, zoning administrators, county commissioners, city councils, and other staff and elected officials to make informed decision on how small wind machines will be addressed in community plans and zoning ordinances. Recommendations and model language that could be adopted in a Minnesota community are included. Also considered are the goals and policies on wind machines that can be integrated into a comprehensive plan or other planning documents. Amendments to subdivision and planned unit development regulations to encourage the use of wind machines are also discussed. (LEW)

1704 Economics

32992 **(NP—4901132) Recommended practices for wind turbine testing. 2. Estimation of cost of energy from wind energy conversion systems. 1. Edition 1983.** Nitteberg, J. (ed.). (Institute for Energy Technology, Kjeller (Norway)). 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84901132.

A standard methodology for comparing the cost of energy produced by wind energy conversion systems (WECS) available in the market is provided. The method is not limited to electricity-producing WECS and is generally applicable to WECS of all sizes and classifications as well as power stations containing a group of WECS. The method of cost estimation adopted in the recommended procedure is based on the use of the so-called real interest rate, which in a way reflects the total cost during lifetime, taking into account the combined effect of interest and inflation. The method is based on the estimation of the actualized cost of future expenditure. The data required is supplied on the Standard Technology Questionnaire (STQ) which covers organizational, system, technical, and cost data. (LEW)

32993 **(SERI/TR—211-2318) Wind energy systems for electric utilities: a synthesis of value studies.** Flaim, T.; Hock, S. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84004520.

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Since 1975, a substantial amount of research has been completed related to the impact of wind energy conversion systems (WECS) on electric utilities. Eight major studies have estimated the value of wind systems - the amount the utility could afford to pay for wind turbines with no cost or reliability penalties. However, each of these studies was completed at different times, reflected different economic assumptions, and reported results in different base-year dollars. The result is that while these reports contain a substantial amount of useful information, their results are difficult to compare and interpret directly. This report describes briefly the basic value analysis methodology as it exists today, identifies unresolved issues, and normalizes and interprets the results from value analysis studies that have been completed since 1979.

1705 Environmental Aspects

32994 (NE/VIND—83-16) Birds and wind power. Technical report 1977-1982. Karlsson, J. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Feb 1983. 181p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84751013.

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The impact of wind power plants on birds has been studied. The risk of migrating birds colliding with high buildings has been investigated. Different hazards and accidents are described and reported in 12 appendices. Preliminary data from the sites of wind power plants are presented.

32995 (NE/VIND—83-17) Birds and wind power. Result report 1977-1982. Karlsson, J. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Feb 1983. 14p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751012.

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Two large-scaled aerogenerators were erected in Sweden in 1980-82. Questions about how birds react on the generators were raised early. Theoretical calculations about the risk for collisions between migrating birds and the generators, together with data on the bird collision frequencies at radio- and television towers in Sweden were presented in a report in 1978. It was assumed that the collision frequency will normally not exceed five birds per night during nights with normal traffic rate of migrating birds, and with maximum of about 50 birds on special occasions (few cases per season). In 1979-1982 the local breeding bird fauna was censused in the immediate vicinities of the sites (arable land and grazed bushland) where the aerogenerators has been erected. The results obtained so far, do not indicate any effect at all on species diversity or abundance when comparing the situation before and after the erection of the arerogenerators. Some species have successfully colonized the areas, obviously exploiting resources created by the building activities. Two such species are Oenanthe oenanthe and Delichon urbica. Reactions of migrating birds when passing close to the generators will be studied in the nearest future (autumn 1983) when the plants will be in continous work.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 32942

32996 (AD-A—138841/2) Wind power generation design considerations. Final report. Elischer, E.; Windingland, L.M. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Dec 1984. 34p. (CERL-TR-E—191). NTIS, PC A03/MF A01.

Guidance is provided for the design of a wind power generation system suitable for Civil Works operational sites. The choice of components for a given system is discussed in terms of the highest efficiency possible at the proposed site. Guidance also is given for site selection to minimize environmental impact and maximize the rotor's wind exposure.

32997 (BMFT-FB-T—84-017) Meteorological measurements in the Northern German coastal area for wind energy prospection. Tetzlaff, G.; Theunert, S.; Hoff, A.; Laude, H.; Belitz, H.J.; Beyer, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Hannover Univ. (Germany, F.R.). Inst. fuer Meteorologie und Klimatologie). Jan 1984. 221p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84751422.

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Wind speed and direction were measured for the period from April 1979 to February 1982. The wind sensors were mounted at the towers up to a maximum height of 46 m at six different sites in the northern German coastal area. The raw data were checked, converted to physical units and corrected if necessary. The data in final form are organized in a data bank with easy acess. The results for the measuring period were compared to long term geostrophic wind data and then matched. To interpolate horizontally and vertically analytical, statistical and numerical methods were applied. The wind data then served to compute the wind power potential and the energy yield of a wind energy converter (GROWIAN). The wind forecast accuracy and the spacing of wind energy converters were estimated in addition to the data evaluation.

32998 (ECN—83-181) Comparison of the calculations of the computer program WEPP with actual measurements of the 25 m HAT and Polenko WPS-16-A60. Curvers, A. (Stichting Energieonderzoek Centrum Nederland, Petten). Nov 1983. 16p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The computer program WEPP calculates, starting from a Cp-lambda characteristic and simple models for losses in gear-box and electric generator, a power characteristic which can be used for predicting performances of wind turbines. Results are compared with tests performed at two wind turbines located at the ECN test field.

32999 (ECN—141) On the systematic errors in the measurement of the aerodynamic performance of a WECS by the method of bins. Dragt, J.B. (Stichting Energieonderzoek Centrum Nederland, Petten). Nov 1983. 29p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750912.

The systematic errors that may be obtained in determining the power (or torque) performance curve of a wind energy conversion system by the method of bins are discussed. Errors are due to lack of correlation of wind speeds, either in time due to dynamic effects (for which correction by measurement is possible), or in space (which can be allowed for by a computed correction). The way of measurement and analysis are discussed in some detail. A theory is given on how to calculate the systematic errors quantitatively. Recommendations are given for keeping the errors as small as possible. For the situation that errors can not be made negligible a method is developed to correct the performance curve, using only the experimental data. The alternative inverse method of bins is shown to produce errors in the opposite direction and to have some advantages under certain circumstances. The theory has been confirmed in a satisfactory way by experiments in a 15 m vertical axis wind turbine and a 25 m horizontal axis wind turbine.

33000 (Juel-Spez—203) Implementing agreement for cooperation in the development of large scale wind energy conversion systems. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung). Apr 1983. 59p. (CONF-8205261—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751418.

From 8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing; Stockholm, Sweden (26 May 1982).

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From May 26-27 1982, the '8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing' took place at Stockholm, organized by the Project Management for Energy Research (PLE) of the Nuclear Research Establishment Juelich (KFA). The 5 papers at this symposyum are concerned with problems of safety engineering and of quality assurance for wind power plants. Separate abstracts were prepared for each paper.

33001 (Juel-Spez—203, pp 1-7) Swedish prototype Naesudden. Svensson, G. Apr 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number TI84751418. (CONF-8205261—).

From 8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing; Stockholm, Sweden (26 May 1982).

Within the framework of the Swedish Wind Energy programme a large wind energy plant was erected at Naesudden on the Island of Gotland. Energy production is estimated to 6 GWh/year and the design life is 30 years. The constructional characteristics of the plant are described as well as the rotor blades, hub, tower and machinery. Moreover, the contribution briefly deals with the electrical systems and the control devices. Furthermore, safety assurance, quality control and technical as well as constructional characteristics especially during assembly, erection and acceptance

are described. Within the serial production of this unit type other test methods must be performed.

33002 (Juel-Spez—203, pp 9-20) **Redundancey in the process systems of large scale WECS.** Christiansen, P. Apr 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number TI84751418. (CONF-8205261—).

From 8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing; Stockholm, Sweden (26 May 1982).

One of the activities of the Danish wind energy programme has been to build and operate two Nibe turbines. Both Nibe prototypes are described - Nibe A and Nibe B. The number of and reasons for emergency stops of the Nibe B prototype during an operating time of 2400 hours are investigated and presented. It can be shown that the bulk of failures was caused by external factors. Some design guidelines are derived herefrom. They also refer to the hardware.

33003 (Juel-Spez—203, pp 21-29) **Standard procedures, glossary and requirements.** Simpson, P.B. Apr 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number TI84751418. (CONF-8205261—).

From 8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing; Stockholm, Sweden (26 May 1982).

Discussion of quality assurance of wind turbine generators should be based on an appreciation of the standard procedures that are now adopted in numerous fields for the application of quality assurance principles. This contribution therefore represents a summary of the basic terminology and requirements of quality assurance, making reference to the principle British Standards Institution Publications relating to the subject.

33004 (Juel-Spez—203, pp 31-42) **Problem prevention for large wind energy converters.** Schwarte, M. Apr 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number TI84751418. (CONF-8205261—).

From 8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing; Stockholm, Sweden (26 May 1982).

The quality of wind energy plants has a great influence on their economy. Today we have learned, from the operation of some large wind energy plants, where the technical limits of wind energy plants lie. One can also evaluate in which fields the most efficient and economically reasonable solutions can be found. They also determine the conditions for the design of future plants. This is particularly important for the developing countries and threshold countries where wind energy plants can provide a considerable contribution to energy supply. The author deals with the optimal size of plants, quality assurance, tower design as well as the technical equipment.

33005 (Juel-Spez—203, pp 43-55) **Safety assurance and quality control of GROWIAN.** Zwahr, H. Apr 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number TI84751418. (CONF-8205261—).

From 8. meeting of experts - safety assurance and quality control of LS WECS during assembly, erection and acceptance testing; Stockholm, Sweden (26 May 1982).

Safety aspects and quality control of the large wind energy plant Growian are considered under two aspects. On one hand, the relation between the safety standards and constructional design on the other, the control activities of the operating firms are dealt with. The safety problem during the successive erection of the plant, construction and production is described. The quality control system, measures against corrosion, safety measures in the electro technical equipment, etc. are described in detail.

33006 **(NP—4901417) Recommended practices for wind turbine testing. 1. Power performance testing. 1. Edition 1982.** Frandsen, S.; Trenka, A.R.; Pedersen, B.M. (eds.). (Risoe National Lab., Roskilde (Denmark); Rockwell International Corp., Golden, CO (USA). Wind Systems Program; Danmarks Tekniske Hoejskole, Lyngby). 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84901417.

This document describes the recommended practices for testing and reporting power performance characteristics of wind energy conversion systems (WECS). It provides a standard methodology for comparing the energy production characteristics of WECS available in the market. The methods presented are not limited to WECS that produce electricity. The procedures and practices are generally applicable to WECS of all sizes and classifications. Formulae are given for wind shear correction, correction of power for air density variations, and for the determination of the power curve from data. Results of the tests include mean power and annual energy output. (LEW)

33007 **(PB—84-164680) Mathematical modelling of wake interaction in wind turbine arrays. Part 1. Description and evaluation of the mathematical model.** Vermeulen, P.E.J.; Builtjes, P.J.H. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). 1981. 61p. NTIS, PC E04/MF E01.

This report gives a general description of a computermodel (MILLY) which can be used to calculate the mean velocity field within a cluster of wind turbines and thus to predict the power reduction caused by wake interaction effects. The predictions of this computermodel and those of two earlier models are compared with experimental data obtained by static wind turbine simulators. It is concluded that the model predictions are close to the measurement results so that engineering estimates of power output of wind turbine clusters can be made. (Copyright (c) Netherlands Organization for Applied Scientific Research TNO 1981.)

33008 **(PNL-SA—12244) Basic principles and recent observations of rotationally sampled wind.** Connell, J.R. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 16p. (CONF-8405153—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013267.

From Horizontal-axis wind turbine technology conference; Cleveland, OH, USA (8 May 1984).

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The concept of rotationally sampled wind speed is describd. The unusual wind characteristics that result from rotationally sampling the wind are shown first for early measurements made using a 8-point ring of anemometers on a vertical plane array of meteorological towers. Quantitative characterization of the rotationally sampled wind is made in terms of the power spectral density function of the wind speed. Verification of the importance of the new concept is demonstrated with spectral analyses of the response of the MOD-0A blade flapwise root bending moment and the corresponding rotational analysis of the wind measured immediately upwind of the MOD-0A using a 12-point ring of anemometers on a 7-tower vertical plane array. The Pacific Northwest Laboratory (PNL) theory of the rotationally sampled wind speed power spectral density function is tested successfully against the wind spectrum measured at the MOD-0A vertical plane array. A single-tower empirical model of the rotationally sampled wind speed is also successfully tested against the measurements from the full vertical plane array. Rotational measurements of the wind velocity with hotfilm anemometers attached to rotating blades are shown to be accurate and practical for research on winds at the blades of wind turbines. Some measurements at the rotor blade of a MOD-2 turbine using the hotfilm technique in a pilot research program are shown. They are compared and contrasted to the expectations based upon application of the PNL theory of rotationally sampled wind to the MOD-2 size and rotation rate but without teeter, blade bending, or rotor induction accounted for. Finally, the importance of temperature layering and of wind modifications due to flow over complex terrain is demonstrated by the use of hotfilm anemometer data, and meteorological tower and acoustic doppler sounder data from the MOD-2 site at Goodnoe Hills, Washington.

33009 **(PNL-SA—12245) Large HAWT wake measurement and analysis.** Miller, A.H.; Wegley, H.L.; Buck, J.W. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 9p. (CONF-8405153—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013269.

From Horizontal-axis wind turbine technology conference; Cleveland, OH, USA (8 May 1984).

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From the theoretical fluid dynamics point of view, the wake region of a large horizontal-axis wind turbine has been defined and described, and numerical models of wake behavior have been developed. Wind tunnel studies of single turbine wakes and turbine array wakes have been used to verify the theory and further refine the numerical models. The effects of scaling, rotor solidity, and topography on wake behavior are questions that remain unanswered. In the wind tunnel studies, turbines were represented by anything from scaled models to tea strainers or wire mesh disks whose solidity was equivalent to that of a typical wind turbine. The scale factor compensation for the difference in Reynolds number between the scale model and an actual turbine is complex, and not typically accounted for. Though it is wise to study the simpler case of wakes in flat topography, current indications are that wind turbine farm development is actually occurring in somewhat more complex terrain. Empirical wake studies using large horizontal-axis wind turbines have not been thoroughly composited, and, therefore, the results have not been applied to the well-developed theory of wake structure. The measurement programs have made use of both in situ sensor systems, such as instrumented towers, and remote sensors, such as kites and tethered, balloon-borne anemometers. A concise overview of the work performed was based on the philosophy that the MOD-2 turbines were probably the best detector of both the momentum deficit and the induced turbulence effect downwind. Only the momentum deficit aspects of the wake-machine interactions have been addressed. Both turbine power output deficits and wind energy deficits as measured by the onsite meteorological towers have been analyzed from a composite data set. The analysis has also evidenced certain topographic influences on the operation of spatially diverse wind turbines.

33010 **(RFP—3638) Design of a digital telemetry data collection system.** Carlson, J.N. Jr. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Dec 1983. Contract AC04-76DP03533. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013916.

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Collecting load data from rotating wind system components is often an integral part of research and development performed at the Department of Energy's Wind Energy Research Center (WERC) at Rocky Flats, Colorado. In order to avoid problems commonly encountered with conventional methods of data collection (i.e., signal noise caused by sliprings and the high cost of multichannel telemetry systems), a unique digital telemetry system was designed using off-the-shelf components. This flexible system not only has reduced size and cost, when compared to a previously used telemetry system, but has also proved to be very accurate in actual application. The purpose of this report is to discuss the design and operation of this system, as well as the rationale for its use.

33011 **(RFP—3678) Analysis of wind turbines in yaw.** Wilson, R.E.; Chaiyapinunt, S. (Oregon State Univ., Corvallis (USA). Dept. of Mechanical Engineering). Sep 1983. Contract AC04-76DP03533. 168p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013620.

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The yaw problems of a three-bladed, downwind, horizontal axis wind turbine are examined in this report. A four-degree-of-freedom system was chosen to model the turbine. Linearized equations of rotor and nacelle motion were developed using the energy method and Lagrange's equations. Quasi-steady blade element and momentum theories were used in developing the axial induction factor and aerodynamic loads. A computer code was developed to obtain the numerical values of coefficients of the equations of motion, thus allowing the cause of yaw instability to be studied. The study indicated that yaw tracking error is primarily caused by tower shadow. However, the wind turbine studied - besides being unstable in yaw under normal operating conditions - has an additional problem in that the nacelle shape contributes to additional instability. Blade coning, in the present design, is inadequate to overcome this instability. The sensitivity of the system stiffness coefficients to the selected input parameters was studied, and results indicate that the system stiffness coefficient is highly sensitive to the coning angle. Increasing the coning angle could significantly increase the stiffness coefficient and lead to improvement of system stability.

33012 **(RISO-M—2400) Testreport for Bonus windmill: prototype 55 kW from Danregn Vindkraft A/S. Standard measurements.** Rasmussen, P. (Risoe National Lab., Roskilde (Denmark)). Oct 1983. 36p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751005.

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This report contains measurements carried out using the standard procedure. The measurements give information about annual energy output, stall power regulation, system efficiency, and loads at cut-in and braking. Furthermore the top pressure at the tower has been measured.

33013 **(SAND—84-7001) Calculation of the pressure distribution on a pitching airfoil with application to the Darrieus Rotor.** Ghodoosian, N. (Oregon State Univ., Corvallis (USA). Dept. of Mechanical Engineering). May 1984. Contract AC04-76DP00789. 130p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013571.

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An analytical model leading to the pressure distribution on the cross section of a Darrieus Rotor Blade (airfoil) has veen constructed. The model is based on the inviscid flow theory and the contribution of the nonsteady wake vortices was neglected. The analytical model was translated into a computer code in order to study a variety of boundary conditions encountered by the rotating blades of the Darrieus Rotor. Results indicate that, for a pitching airfoil, lift can be adequately approximated by the Kutta-Joukowski forces, despite notable deviations in the pressure distribution on the airfoil. These deviations are most significant at the upwind half of the Darrieus Rotor where higher life is accompanied by increased adverse pressure gradients. The effect of pitching on lift can be approximated by a linear shift in the angle of attack proportional to the blade angular velocity. Tabulation of the fluid velocity about the pitching-only NACA 0015 allowed the principle of superposition to be used to determine the fluid velocity about a translating and pitching airfoil.

33014 **(SERI/STR—211-2277) Conceptual design of an electrofluid dynamic wind energy system. A subcontract final report.** Minardi, J.E.; Lawson, M.O. (Dayton Univ., OH (USA). Research Inst.). May 1984. Contract AC02-83CH10093. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84004512.

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This report contains a conceptual design of the electrofluid dynamic (EFD) wind-driven generator and performance estimates used to select the electrode spacing and other parameters. Various spacings and tube sizes in different wind fields were considered to assess the effects of different parameters. Although a detailed stress analysis was not done, preliminary estimates indicate that the tower design will withstand head-on winds in excess of 100 mph (44 m/s) without damage. Many opportunities appear to exist to cut the cost of an EFD wind-driven generator. Maintenance and downtime on this wind-driven generator should be less than for a conventional system with many units having rotating parts. The EFD wind-driven generator also does not require additional power conditioning for long-line power transmission. It should be possible to produce EFD wind driven-generators that are cost competitive with other methods of producing a high-voltage dc power, once a charging system is developed.

33015 **Is the wind a practical source of energy for you?.** Golden, CO; Rockwell International (1980). 10p. GPO. Contract AC04-76DP03533.

This pamphlet gives an introduction to the facts which must be considered in determining the feasibility of wind energy. These facts include determining energy requirements, the available wind energy resource, and the equipment needed to convert and use the

available energy. The cost of energy including advantages offered by the Federal Energy Credit and state tax incentives for wind systems must be considered. The steps for determining the practicality of a wind system are discussed.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 33476

33016 **(CONF-840576—5) Persistence of the Hopf bifurcation under singular perturbations.** Abed, E.H. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). May 1984. Contract AC01-82CE76221. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013871.

From International symposium on circuits and systems - ISCAS'84; Montreal, Canada (7 May 1984).

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The purpose of this paper is to study persistence of the Hopf bifurcation under singular perturbations of the associated vector field. Both single parameter and multiparameter singular perturbation problems are considered. In each case, hyperbolicity of an associated fast time system is shown to imply persistence. For single parameter singular perturbation problems, we employ Fenichel's center manifold theorem for singularly perturbed systems [1] to prove regular degeneration of the bifurcated periodic solutions and to study their stability.

33017 **(CONF-840652—4) Analysis of small disturbance stability regions of power system models with real and reactive power flows.** Liu, C.C.; Wu, F.F. (Washington Univ., Seattle (USA). Dept. of Electrical Engineering; California Univ., Berkeley (USA)). Jun 1984. Contract AC01-82CE76221. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013872.

From American Automatic Control conference; San Diego, CA, USA (6 Jun 1984).

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Small-disturbance (SD) stability regions of power systems models incorporating bus voltage variation and the real and reactive power flow equations are analyzed. It is shown that SD stability regions may be disconnected. Furthermore, the regions contain finitely many components in a compact domain of interest. A sufficient condition is derived for a domain to have a unique SD stable solution of the real and reactive power flow equations. Other analytic properties of the SD stability regions are also investigated.

33018 **(DOE/ET/29038—1) Research progress in dynamic security assessment.** (Analytic Sciences Corp., Reading, MA (USA)). Dec 1982. Contract AC01-79ET29038. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013140.

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Areas discussed are power system modeling, state estimation, structure decomposition, state forecasting, clustering and security measure development. A detailed dynamic model of a multi-machine power system has been developed. A process state estimator was developed to estimate the long-term dynamic behavior of the power system. The algorithm is identical to the extended Kalman filter but has a modified process noise driving term. A two-stage structure estimation technique was proposed for identifying the power system network configuration. Two approaches to structure decomposition were investigated. A time-scale decomposition of the system equations, based on a singular perturbation approach, was evaluated using a detailed model of a generating system. Spatial decomposition was examined by applying an optimal network decomposition technique to a 39-bus test system. Stochastic approximation based approaches to estimator simplification were examined. Explicit expressions were obtained for the evolution of the first and second moments of the system state. Research into security measures proceeded in three directions. The first area involves viewing the security assessment problem as a hyperplane crossing problem for a stochastic process. The second approach examined the stability of an unforced linear system where the system coefficients are subject to future jumps. The third area of research has led to the formulation of a security measure suitable for on-line assessment of transient stability.

33019 **(DOE/ET/29364—1) Probabilistic steady-state and dynamic security assessment.** (California Univ., Berkeley (USA)). Mar 1984. Contract AC01-79ET29364. 159p. NTIS, PC A08; 3; GPO Dep. Order Number DE84013572.

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Discussed are: state-of-the-art in security assessment, framework for probabilistic steady-state and dynamic security assessment, steady-state security regions, dynamic security regions, dynamic reliability, external network modeling, and dynamic equivalents. (DLC)

33020 **(DOE/RA/50419—1) Decentralized system theory.** Berger, T. (Cornell Univ., Ithaca, NY (USA). School of Electrical Engineering). May 1984. Contract AC01-80RA50419. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013658.

The research done under this grant deals with different aspects of decentralized systems theory in the context of large-scale systems. Our contributions fall in three main areas - decentralized communication theory, decentralized information theory, and decentralized control.

33021 **(DOE/RG/10409—T2) Hayden Station: power plant maintenance system preventive maintenance program.** (Colorado-Ute Electric Association, Inc., Montrose (USA)). 15 Jun 1984. Contract FG01-80RG10409. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013309.

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The Initial Report and the First Interim Progress Report included a copy of the Preventive Maintenance Questionnaire. In the past two years, the rating went from 80 (excellent) to 82 (excellent). Progress is still being made in most areas but it consists of fine tuning the existing programs. The Generation Statistics are included. The availability factor for the past 12 months was 79.3% for Unit No. 1 and 93.9% for Unit No. 2, an improvement of 5.3% and 5.9%, respectively, over 1980.

33022 **(EPRI-EL—3505) Revenue-metering device for HVDC systems. Final report.** Schweitzer, E.O. III; Ando, M.; Aliaga, A.; Baker, R.; Seamans, D. (Washington State Univ., Pullman (USA). Dept. of Electrical and Computer Engineering). May 1984. 299p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920413.

This final report describes a digital dc revenue metering device for HVDC systems developed by Washington State University researchers under a contract with the Electric Power Research Institute. The device was installed at the Sylmar Converter Station of the Los Angeles Department of Water and Power in November 1981, and has been operating satisfactorily for over 20 months. It uses voltage and current measurements from existing voltage dividers, current transductors, and a current shunt. The energy-computation algorithms are implemented using digital signal processing principles in a single eight-bit microprocessor (Motorola MC6809). The algorithms accommodate the different characteristics of the sensors, and tolerate the unavailability of some of the sensors, with some loss in accuracy. Comparisons of the dc Revenue Meter energy measurements with the ac revenue meter measurements plus the station losses reveal a 0.1 percent difference in one pole and a one percent difference in the other pole, for a net difference of about one-half percent.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 33469, 33913

33023 **(CONF-840804—12) Overview of design of advanced fossil fuel systems (DAFFS) study.** Bomkamp, D.H.; Bezella, W.A.; Smith, R.S.; Pietruszkiewicz, J. (Argonne National Lab., IL (USA); Bechtel Group, Inc., San Francisco, CA (USA)). 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011725.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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The objective of the DAFFS (Design of Advanced Fossil Fuel Systems) study was to characterize the costs and performance of three advanced power generation technologies: Pulverized Coal Fired with Advanced Flue Gas Desulfurization, Pressurized Fluidized Bed, and Integrated Gasification Combined Cycle. Uniform ground rules and a 1990 state-of-the-art frame of reference were established to obtain designs incorporating reasonable and comparable extrapolations from present levels of performance. The study is intended to provide baseline reference data for future estimates of the potential benefits of component and performance development beyond the levels assumed in the study.

33024 **(DOE/ET/29365—11) Emergency state control methods. Executive Summary.** (Purdue Univ., Lafayette, IN (USA)). May 1984. Contract AC01-79ET29365. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013320.

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This research is divided into two parts: Part I - Study of Several Emergency State Control Methods and Part II - Decentralized Control of Large Transients in Power Systems. The work under Part I is divided into the following areas of investigation: phase rotation as a means of augmenting transient stability; the development of a simplified functional representation of a static VAR system for the study of subsynchronous damping controls; underfrequency load shedding; transient stability enhancement in multimachine power systems using braking resistors; simulation of the New England Test System; and reactive power control to alleviate bus voltage violations in an ac-dc system. These areas all have the focus of improving system stability in the emergency state. In this report each of these areas of research is summarized. Part II of the contract (Decentralized Control of Large Transients in Power Systems) is reported in detail in a separate document (TR-EE 83-25). Briefly the report summarized the research conducted in the decentralized control of interconnected systems with applications to ac/dc Multiterminal Systems and a nonlinear controller design of two interconnected synchronous machines.

33025 **(EPRI-EL—3391) High-voltage stator winding development. Final report.** (General Electric Co., Schenectady, NY (USA)). Apr 1984. 282p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920318.

This report describes the work funded by the Electric Power Research Institute, Inc. for assessing the technical and economical feasibility of developing transmission-level-voltage superconducting generators for central station electric utility applications. Section 1 provides a summary of the study and describes the purpose, objectives, and the general conclusions of the study. Section 2 describes the monolith cylinder armature design, which was selected as the concept having the best chance of proving to be technically and economically feasible. Section 3 describes the commercial acceptance tests necessary to qualify the insulation systems of high-voltage generators. Section 4 describes the power system considerations of connecting high-voltage generators directly to the transmission lines. Section 5 describes several secondary high-voltage generator design concepts and the reasons for their technical and economical infeasibility. Section 6 describes economic analyses comparing the long-term economic benefits of low-voltage and high-voltage superconducting generator development programs. Section 7 summarizes the final design recommendation for the monolith cylinder armature and discusses the reasons for its selection and some of its known limitations. Section 8 describes a possible follow-on hardware development program which would be necessary to confirm the results of the analytical studies discussed in this report.

33026 **(EPRI-NP—3538) Design and fabrication of steam turbine disc NDE test-bed facilities. Final report.** Beverly, R.L.; Van Der Veer, W.R.; Reinhard, B.W.; Light, G.M. (Southwest Research Inst., San Antonio, TX (USA)). May 1984. 43p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920419.

Two nondestructive examination test-beds have been built to support the development of improved ultrasonic examination techniques for steam turbine discs. These test beds have been designated the static test-bed and the dynamic test-bed. The static test-bed, consisting of a stationary disc segment, manually operated scan mechanism, and immersion tank, was designed to support the development of ultrasonic techniques utilizing focused, immersion transducers for examination of the bore and keyway region of discs on assembled steam turbine rotors. The dynamic test-bed, on the other hand, was to simulate field inspection conditions by rotating a full-bladed disc at a low angular velocity. The speed of disc rotation, provided by a set of powered turning rolls, can be accurately controlled over a range of approximately 80:1. The angular position of the disc, precisely encoded and displayed on a digital readout, is reproducible to +-0.001 degree. Although the dynamic test-bed presently has no provisions for ultrasonic technique development, the static test-bed scan mechanism is expected to be adapted to the dynamic test-bed in the future. This report describes the design considerations, operational capabilities, and repeatability and verification testing associated with these test-beds.

33027 (INIS-mf—8861, pp 389) **Reliability prediction of different on-line control systems.** Welfonder, E.; Jaeckel, K. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

The reliability of different on-line control systems was compared. The digital concept with multiple-purpose microprocessor modules was found to be only slightly more reliable than the conventional concept of single-purpose IC modules. Further, bus signal transfer is only slightly less efficient than parallel signal transfer. Digital concepts with bus signal transfer are less efficient by a factor 1.6. stronger variation of single parameters did not affect the validity of the comparison.

33028 (INIS-mf—8861, pp 389) **Experience with differential pressure devices for flow metering in acceptance and control testing.** Herbst, R. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

Standardized differential pressure devices are discussed on the basis of long-term practical experience in acceptance testing and inspection. The error margin of the devices should be as narrow as possible. The different requirements of in-service measurements, acceptance tests and inspections must be taken into account. The paper, which is based on the VDI rules for flow metering, DIN 1952 of August 1971, comprises the three sections: 1. Design of differential pressure devices; 2. Testing; 3. Installation.

33029 (INIS-mf—8861, pp 389) **Possibilities and procedures for maintenance of on-line control systems.** Goertz, G.; Boesken, W. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

At HEW, the power plant and network operation, maintenance and control functions are concentrated in a single department. Power plant operation comprises control and servicing as well as detection and removal of failures. The repair service is responsible for large-scale repair and, according to a certain schedule, revisions and maintenance of all HEW facilities. Large machines, large electrical components and control system components are repaired in a central repair shop. The author describes the structure of the operating and maintenance department with a view to the control systems.

33030 (INIS-mf—8861, pp 389) **First results of outage statistics of on-line control systems.** Houzer, H.G. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

A detailed statistics of outages of on-line control systems was started in 1981 in the framework of VGB failure statistics. The reasons for this, the targets, extent and initial results are presented, and the necessary further research activities are presented.

33031 (INIS-mf—8861, pp 389) **Present on-line control concepts - necessity or luxury.** Wetzl, R. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

Information is given on the following subjects: Extent of on-line control; selection of protective and monitoring systems with a view to plant protection and availability; strain for the power plant personnel due to excessive information and new technologies; user-friendly arrangement of the operating and monitoring equipment in the control room; computer applications; future power plant instrumentation; maintaining the diversity of equipment and producers in spite of the general introduction of bus systems. The article closes with a rough outline of on-line power plant control in future STEAG power plants and the author's opinion on bus technology in power plants in general.

33032 (INIS-mf—8861, pp 389) **New on-line control generation in the view of the user critical review and requirements.** Hoepner, A.E. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

Despite their advantages, e.g. as regards interfences, the new systems also have some drawbacks. To make optimum use of the new systems - instead of just taking over the functions of the existing systems -, careful planning and some operating experience will be necessary both on the producers' and the users' side. Producers and users will have to reconsider some technical and organisational problems, and early staff training is required for planning, start-up and operation. Standardisation of bus systems and languages is an urgent task for the producers.

33033 (INIS-mf—8861, pp 389) **Ideas to improve on-line control documentation with a view to new on-line control concepts.** Kauffeld, W. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

On-line control documentation, especially of highly automatic power plant units, still has a number of shortcomings which ought to be avoided. The problem is defined, and some solutions are presented. New control systems will bring about considerable improvements. Producers ought to pay more attention to the practical requirements of power plant operation. This, in turn, makes it necessary for the users to define their wishes more precisely.

33034 (INIS-mf—8861, pp 389) **Conception of control room design from the view of the user.** Rick, E. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

The control room of a power plant is the interface between the operators and the technical process. The operators and their tasks are discussed at length, and it is recommended to divide the control room into separate working areas designed according to anthropotechnical considerations. Apart from air conditioning, lighting and acoustics, the control room layout is also influenced by the division of functions between man and machine. Several examples of control room concepts are presented.

33035 (INIS-mf—8861, pp 389) **Planning experience with a modern on-line control concept.** Herrmann, G. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

The on-line control system for unit 7 of Grosskraftwerk Mannheim AG has been ordered from BBC. This unit is the first to be equipped with a complete on-line control system covering the functions of data acquisition, transfer and processing by a bus system. The project is described in order to give an impression of its scope and difficulties. Unit 7 is a combined heat-and-power plant for electric power generation and district heating, with a total installed capacity of 475 MW. A single-flue steam generator with a height of 108 m, with a supercritical live steam of 260 bar, 530°C and double intermediate superheating of the flue gas produces 1370 t/h of live steam which is led onto a serially connected back-pressure turbine with intermediate superheating at 40 to 100 bar (load-dependent sliding pressure) and a back-pressure of 20 bar. Turbine M has a rated capacity of 195 MW el.

33036 (INIS-mf—8861, pp 389) **Status and trends of turbine control.** Pleesz, N. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

With the increasing number of interconnected systems and the resulting higher demands on turbogroup automation, also the demands on turbine control systems have become more stringent. Permissible variations have become smaller and higher reliability is required. On-line control systems can meet these demands.

33037 (INIS-mf—8861, pp 389) **On-line control systems in auxiliary devices.** Stoehr, H.J. 1982. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780509.

From VGB conference on on-line control systems in power plants 1982; Essen (Germany, F.R.) (1982).

Auxiliary systems are either attached to single power plant units, or they may serve several or all units of a power plant. Depending on the process, different modes of operation are possible. The degree of automation and availability depend on the mode of operation, length of operating periods, and number of operating periods in a given time interval. Independent, continuously operating auxiliary systems are: Waste water disposal systems, waste disposal systems, HVAC systems, service water supply systems, compressed-air systems.

33038 (MIT-EL—84-006) **Effects of technological change, experience and environmental regulation on the construction costs of coal-burning generating units.** Joskow, P.L.; Rose, N.L. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Mar 1984. Contract AT01-76EV70012. 73p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84012737.

This paper provides an empirical analysis of the technological, regulatory and organizational factors that have influenced the costs of building coal-burning steam-electric generating units over the past twenty year. We obtain empirical estimates of economies of scale in construction costs, learning effects associated with utilities and architect-engineers, the costs of environmental regulation, patterns of construction productivity, and cost differences between generating technologies. The analysis is based on a sample of over 400 generating units placed in operation between 1960 and 1980. Information on generating unit availability is integrated with the construction cost evidence to suggest that the abandonment of supercritical technology in the early 1980's is likely to be a consequence of poor operating performance as well as sharply reduced demand expectations rather than a consequence of high construction costs for this technology at large scale. 29 references, 1 figure, 10 tables.

33039 (NE—1983-19) **Cogeneration of electric power and heat by small plants. Possible techniques, need of development and conceivable energy supplies in Sweden.** Gustafsson, B.; Johansson, A.; Kjellstroem, B. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Jun 1983. 388p. (In Swedish). NTIS (US Sales Only), PC A17/MF A01. Order Number DE84751007.

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The possible introduction of small cogeneration plants for electric power and heat is discussed. It is planned to use domestic solid fuels with the size of the plants not exceeding 25 MW with a heat energy of 50 MW. The future needs are estimated to be between 3 and 41 TWh per year by the year 2010, as produced by

small plants. Various small power plant techniques are described and discussed (G.B.).

33040 **(NEAC—19) Electricity in the Australian energy market.** (National Energy Advisory Committee (Australia)). 1983. 47p. Australian Government Publishing Service, Canberra.

Within the summary of conclusions and recommendations, the National Energy Advisory Committee investigating electricity in the Australian energy scene, made the following point: the Australian electricity supply industry is faced with the need for a further substantial expansion over the next decade (albeit at a lower rate than over the past decade) requiring the expenditure of tens of billion of dollars. Some savings in this expenditure could be achieved if the utilization of the installed plant, currently amounting to 3710 kWh per annum per kW of installed capacity (42 per cent), could be improved. Capital savings of this kind should be pursued only to the extent that they are economically worthwile, i.e. to the extent that they would result from the application of appropriate pricing and related policies. Appropriate pricing policies would include the greater use than at present of maximum demand charges and time of day tariffs.

33041 **(OEFZS—4266) How to increase the efficiency of thermal power stations.** Schwarz, N. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna). Feb 1984. 13p. (In German). (CONF-840159—). Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.

From Seminar on energy-relevant activities; Vienna, Austria (17 Jan 1984).

The development of power stations shows, that within a given technical framework, total thermal efficiencies increase continually. A stepwise increase is achievable with the introduction of new technical developments. Examples are the change from piston engines to vapour-turbines and the introduction of combined cycles with gas turbines. According to the present technical know-how the use of a potassium topping cycle should be the next development step in the construction of power stations. The activities for the realization of such a power station are described.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 32567, 32572, 32573, 32574, 32576, 32577, 32578, 32580, 32581, 32582, 32583, 32584, 32585, 32619, 32623, 32625, 32626, 32628, 32629, 32630, 32631, 32632, 32664, 33023, 33484, 34226, 34237, 34354

33042 **(DOE/FE/60148—T3) Adsorbent regenerator. Monthly progress report, August 1, 1983-September 30, 1983.** (NOXSO Corp., Paducah, KY (USA)). 31 Oct 1983. Contract AC22-82FE60148. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012969.

This report covers work accomplished under DOE Contract No. DE-AC22-FE60148 during the period August 1, 1983 through September 30, 1983. The report presents the detailed design of the prototype moving-bed regenerator which will be built and tested under Phase II of this contract. It also contains experimental results from a test series using hydrogen as a reducing gas and a series using a NOXSO sorbent containing an iron catalyst. It also presents the results of AAJA attrition tests on chemically cycled sorbents containing 9.1% sodium, with and without the iron catalyst. 6 figures, 1 table.

33043 (EPRI-CS—3182-Vol.1, pp 32.1-32.24) **Current status of dry NO/sub x/-SO/sub x/ emission control processes.** Dalton, S.M. Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Combined NO/sub x/-SO/sub x/ control techniques using a variety of complex chemical flue gas treatment processes have been proposed by a number of manufacturers. The wet chemical NO/sub x/-SO/sub x/ processes are generally not economically competitive and development has shifted to dry NO/sub x/-SO/sub x/ techniques. Three dry techniques that are currently being widely pursued as alternatives to wet FGD/selective catalytic reduction are discussed in some detail in this paper: the copper oxide processes, the carbon adsorption processes, and the electron-beam (E-beam) irradiation processes. There are at least five versions of the copper oxide process, eight versions of the carbon adsorption process with No/sub x/-SO/sub x/ reduction and two versions of the E-beam concept. All of these processes appear capable of achieving over 90% SO_2 removal and greater than 70% No/sub x/ removal, although the power plant economic and operational impacts are not fully understood. None of the processes are in service commercially, though active development is underway in the US, Japan, and Germany. 6 references, 8 figures, 7 tables.

2003 Power Transmission And Distribution

33044 **(CONF-831042—) Urban applications of HVDC power transmission.** (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 379p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84012565.

From Symposium on urban applications of HVDC power transmission; Philadelphia, PA, USA (24 Oct 1983).

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Nineteen papers are included, treating topics such as: dc system support, cables, underground transmission, insulators, converters, circuit breakers, etc. (DLC)

33045 **(CONF-840403—2) Current assessment of the potential of dielectric gas mixtures for industrial applications.** Bouldin, D.W.; James, D.R.; Pace, M.O.; Christophorou, L.G. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). Apr 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84011658.

From 4. international symposium on gaseous dielectrics; Knoxville, TN, USA (29 Apr 1984).

The need for more efficient, economical electrical power transmission and distribution has given impetus to the investigation of new insulating gases. Since no single gas can meet all of the multiple needs and operating conditions that exist in power apparatus, mixtures have been studied with the goal of tailoring the dielectric for a specific application by exploiting the properties of the component gases. This report reviews research results on dielectric gas mixtures and assesses the potential of such mixtures for industrial applications. The topics considered include electrical breakdown characteristics, physical and chemical properties, and economics.

33046 **(CONF-840576—3) Application of singular perturbation techniques to power system transient stability analysis.** DeMarco, C.L.; Bergen, A.R. (California Univ., Berkeley (USA)). 1984. Contract AC01-82CE76221. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014007.

From International symposium on circuits and systems - ISCAS'84; Montreal, Canada (7 May 1984).

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This work extends Lyapunov techniques for power system transient stability analysis to system models incorporating voltage magnitude variation, real and reactive power loads, and flux decay effects. A method of estimating the domain of attraction of an asymptotically stable equilibrium in the resulting system of differential equations with algebraic constraints is examined.

33047 **(DOE/BP—8) Living and working around high-voltage power lines.** (USDOE Bonneville Power Administration, Portland, OR). Aug 1981. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012151.

This booklet presents safe practices that you should follow if your activities take you near high-voltage transmission lines. It documents information that has generally been available to the public.

33048 **(N—8419844) Static and dynamic behavior of mechanical components associated with electrical transmission lines.** Trainor, P.G.S.; Popplewell, N.; Shah, A.H.; Pinkney, R.B. (Manitoba Univ., Winnipeg (Canada)). Jun 1983. 12p. SVIC, Code 5804, Naval Research Lab.,;Washington, D.C. 20375.

In the Shock and Vibration Digest, Vol. 15, No. 6, pages 27-38 (SEE N84-19841 10-39).

This article describes the behavior of transmission towers, insulator strings, conductors, and foundations as determined from theoretical analyses, model testing, and full-scale tests. Line vibration is also briefly reviewed.

33049 **(NP—4770267) Radial, internal network equivalent for safety monitoring of interconnected networks with a number of regional control centers.** Hager, H. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 3 Jul 1981. 191p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770267.

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Knowledge of suitable equivalents of neighbouring networks is necessary in order to carry out simulations of this kind. Each control centre produces an equivalent network through internal network reduction on its own part of the system and passes it on to the neighbouring control centres. The properties of an equivalent network for this purpose are: Transmission of a small amount of data; simple topology (no intermeshed equivalent); an accuracy just adequate for the purpose; internal node powers are concentrated on equivalent nodes, not displaced to border nodes; access to nodes when applying disturbances; no transmission of detailed operational data; visibility of system response to changes in load and generation. The displacement of internal node powers is avoided by employing the REI equivalent, whilst a meshed network is reduced to a radial tree-shaped equivalent of limited accuracy. A least square fit minimizes the reproduction error and suitable search algorithms yield an optimal tree structure (GRANEQ = General RAdial Network EQuivalent).

33050 **(NP—4770268) Static thyristor controlled regulating transformers for electric power systems.** Gueth, G. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1982. 185p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770268.

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Static thyristor controlled regulating transformers for electric power systems are demonstrated to be attractive devices for power flow control and to provide a substantial improvement in the stability behavior of the power system. A concept of a practical static tap changing regulating transformer is presented which generates essentially no harmonics. The tap positions are changed at discrete points in time corresponding to current zero crossings, hence on-off control can be executed as rapidly as every 10 msec. For practical purposes, this is almost time continuous. A robust control algorithm for the control of a static phase shifting or quadrature boost transformer is presented. The control commands are generated using local measurements (voltage and complex power at the transformer), specified power flow, and imprecise values of equivalent impedances of the power systems. Simulation results of typical single and multimachine power systems are presented to illustrate the operation of the static phase shifting transformer. Further tests on a hardware model, in which programmable power supplies simulate dynamically changing power system voltages, are described. These tests include a wide variety of power system operation conditions which illustrate the effects of the static phase shifting transformer on power flow control, transient stability and steady state stability.

33051 **(ORNL/TM—8724) Summary of multiterminal high-voltage direct current transmission technology.** Biggs, R.B.; Jewell, W.T. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013625.

This report summarizes the present state of multiterminal (MT) high-voltage direct current (HVDC) power transmission. The purpose is to reassess the need for HVDC circuit breakers and to identify needed research for MT HVDC. The fundamentals of this technology are presented, and previous research and development is reviewed. Although no MT HVDC systems have yet been built, many concepts have been proposed. Some require a dc breaker, and others do not. Both options have advantages and disadvantages for various applications, so the selection will depend on the proposed application. Research is needed to define operating characteristics of various MT HVDC systems. In some applications, dc breakers will be useful, so research into HVDC interruption should continue. Also, dc fault detection and control algorithms for MT systems should be studied.

33052 **(UCRL—15613) Power factor improvement study for an electrical power distribution system for University of California, Lawrence Livermore National Laboratory, Livermore, California.** (Brown and Root Development, Inc., San Francisco, CA (USA)). Dec 1983. Contract W-7405-ENG-48. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84012851.

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This report summarizes the results, findings, methods of analysis, and recommendations of a power factor improvement study for the site electrical distribution system of the University of California, Lawrence Livermore National at Livermore, California. The purpose of this study is to determine a suitable means to improve the site power factor to at least an average of 95% in order to preserve the economic advantage of WAPA service.

21 NUCLEAR POWER PLANTS

33053 **(CONF-840916—2) Uncertainty covariances in robotics applications.** Smith, D.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013417.

From Robotics and remote handling in the nuclear industry conference; Toronto, Ontario, Canada (23 Sep 1984).

Portions are illegible in microfiche products.

The application of uncertainty covariance matrices in the analysis of robot trajectory errors is explored. First, relevant statistical concepts are reviewed briefly. Then, a simple, hypothetical robot model is considered to illustrate methods for error propagation and performance test data evaluation. The importance of including error correlations is emphasized.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 32716, 33212, 33214, 33216, 33247, 33252, 33253, 33297, 33299, 33300, 33303, 33304, 33305, 33306, 33307, 33312, 33316, 33317, 33318, 33319, 33320, 33322, 33323, 33325, 33328, 33333, 33335, 33336, 33337, 33339, 33347, 33349, 33350, 33356, 33358, 34329

33054 (EPRI-NP—3347-SR, pp 11.1-11.3) **Backlay clad inspection.** Fleming, M.F.; Humphries, J.C. (Amdata Systems, Inc., San Jose, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Some BWR owners have used weld overlay clad as an interim repair of piping with intergranular stress-corrosion cracking (IGSCC). Accurate inspection techniques are required for determining crack growth after the cladding application. Conventional ultrasonic approaches are unlikely to be adequate. An alternative possibility is the use of a piezoelectric/electromagnetic acoustic transducer (PE/EMAT) system or an EMAT/EMAT system. Purpose of this project is to determine the feasibility and field applicability of the PE/EMAT and EMAT/EMAT system approaches using currently available upgraded transducers.

33055 (EPRI-NP—3347-SR, pp 18.1-18.12) **Experimental surveillance of intergranular stress corrosion crack growth in large pipes.** Bickford, R.L. (Battelle-Northwest Labs., Richland, WA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Intergranular stress corrosion cracking (IGSCC) in 304 stainless steel pipe weldments continues to be a major concern to the nuclear industry. EPRI through the Boiling Water Reactor Owners' Group is conducting extensive research efforts in the de-

velopment of nondestructive instrumentation and techniques for the detection of cracks and monitoring of crack growth. The work reported here supports these crack surveillance efforts by providing realistic specimens for instrumentation development and testing. The program consists of two functions: (a) produce specimens consisting of pipe weldments with backlay cladding applied in various thicknesses; and (b) operate a pipe test stand containing a 26 in. diameter Sch. 80 welded specimen under simulated BWR temperature and water chemistry conditions as a crack surveillance instrument test bed.

33056 (EPRI-NP—3347-SR, pp 19.1-19.16) **Continuous ultrasonic sampling of in-service nuclear plant piping.** Fleming, M.F.; Humphries, J.C. (Amdata Systems, Inc., San Jose, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

The objective of EPRI Contract T104-2 is the development and proof of feasibility of a surveillance system for in-service monitoring of intergranular stress-corrosion cracking (IGSCC) in piping weldments. The surveillance system must be capable of monitoring the pipe weldments for extended periods in the environments characteristic of boiling-water-reactor (BWR) power plants.

33057 (EPRI-NP—3521) **In-plant measurements of electrochemical potentials in BWR water. Final report.** Leibovitz, J.; Kassen, W.R.; Pearl, W.L.; Sawochka, S.G. (NWT Corp., San Jose, CA (USA)). May 1984. 114p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920421.

Long term electrochemical potential (ECP) monitoring in an operating boiling water reactor (BWR) was achieved using improved electrode designs developed at NWT Corporation. The ECP of various materials at 270°C increased toward a long term value independent of the material tested and apparently representative of the BWR piping. The apparent steady state ECP of 304 SS increased from -370 mV in mid-1979, to zero mV in August 1980, and to +100 mV in October 1982. An explanation for this ECP behavior is proposed, and a theoretical relation is developed between long term ECP and radiation buildup, consistent with the plant data. A mechanism of intergranular stress corrosion cracking (IGSCC) of sensitized 304 SS is proposed which indicates that the susceptibility to IGSCC should increase with increasing ECP in the range of ECP observed at the plant, consistent with trends observed in laboratory experiments. Results indicate that in-plant ECP monitoring at BWRs offers a tool for assessing plant changes that are not apparently reflected during the extensive normal plant chemistry measuring program.

33058 (IAEA-SMR—68/2, pp 71-130) **Fundamentals of boiling water reactor (BWR).** Bozzola, S. (AMN Ansaldo Impianti, Genoa (Italy)). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

These lectures on fundamentals of BWR reactor physics are a synthesis of known and established concepts. These lectures are intended to be a comprehensive (even though descriptive in nature) presentation, which would give the basis for a fair understanding of power operation, fuel cycle and safety aspects of the boiling water reactor. In the first lecture general description of BWR is presented, with emphasis on the reactor physics aspects. A survey of methods applied in fuel and core design and operation is presented in the second lecture in order to indicate the main features of the calculational tools. The third and fourth lectures are devoted to review of BWR design bases, reactivity requirements, reactivity and power control, fuel loading patterns. Moreover, operating limits are reviewed. The basic elements of core management are also presented. The constraints on control rod movements during the achieving of criticality and low power operation are illustrated in the fifth lecture. Some considerations on plant transient analyses are also presented in the fifth lecture, in order to show the impact between core and fuel performance and plant/system performance. The last lecture is devoted to the open vessel testing during the startup of a commercial BWR. A control rod calibration is also illustrated.

33059 (IAEA-SMR—68/2, pp 279-322) **Power operation, measurement and methods of calculation of power distribution.** Lindahl, S.O.; Bernander, O.; Olsson, S. (ASEA-ATOM AB, Vaesteraas (Sweden)). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

During the initial fuel loading of a BWR core, extensive checks and measurements of the fuel are performed. The measurements are designed to verify that the reactor can always be safely operated in compliance with the regulatory constraints. The power distribution within the reactor core is evaluated by means of instrumentation and elaborate computer calculations. The power distribution forms the basis for the evaluation of thermal limits. The behaviour of the reactor during the ordinary modes of operation as well as during transients shall be well understood and shall be such that the integrity of the fuel and the reactor systems is always well preserved.

33060 (IAEA-SMR—68/2, pp 351-450) **In-core fuel management for the course on operational physics of power reactors.** Levine, S.H. (Breazeale Nuclear Reactor, Pennsylvania State Univ., University Park (USA)). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

82 refs.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

The heart of a nuclear power station is the reactor core producing power from the fissioning of uranium or plutonium fuel. Expertise in many different technical fields is required to provide fuel for continuous economical operation of a nuclear power plant. In general, these various technical disciplines can be dichotomized into "out-of-core" and "in-core" fuel management. In-core fuel management is concerned, as the name implies, with the reactor core itself. It entails calculating the core reactivity, power distribution, and isotopic inventory for the first and subsequent cores of a nuclear power plant to maintain adequate safety margins and operating lifetime for each core. In addition, the selection of reloading schemes is made to minimize energy costs.

33061 (JAERI-M—83-056) **User input manual for single fuel rod behaviour analysis code FEMAXI-III.** Saito, Hiroaki; Yanagisawa, Kazuaki; Fujita, Misao. (Japan Atomic Energy Research Inst., Tokyo). Mar 1983. 55p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84702048.

Principal objectives of safety related research in connection with light water reactor fuel rods under normal operating condition are mainly addressed to assess fuel integrity under steady state condition and to generate initial condition under hypothetical accident. These assessments have to be based principally upon steady state fuel behaviour computing codes that are able to calculate fuel conditions. To achieve these objectives, efforts have been made to develope an analytical computer code that calculates in-reactor fuel rod behaviour in best estimate manner. The computer code developed for the prediction of the long-term burnup response of single fuel rods under light water reactor conditions is the third in a series of code versions: FEMAMI-III. The code calculates temperature, rod internal gas pressure, fission gas release and pellet-cladding interaction related rod deformation as a function of time-dependent fuel rod power and coolant boundary conditions. This document

serves as a user input manual for the code FEMAMI-III which was opened to the public in year of 1982. A general description of the code input and output are included together with typical examples of input data. A detailed description of structures, analytical submodels and solution schemes in the code shall be given in the separate document to be published.

33062 **(NUREG—0020-Vol.8-No.4) Licensed operating reactors. Status summary report data as of March 31, 1984. Vol. 8, No. 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). May 1984. 411p. NTIS, PC A18/MF A01 - GPO*. Order Number DE84901261.

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The US Nuclear Regulatory Commission's monthly Licensed Operating Reactors Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Resource Management, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

33063 **(NUREG/CR—3523) Ranking scheme for making decisions on the relative training importance of potential nuclear power plant malfunctions.** Selby, D.L.; Hensley, W.T. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 113p. (ORNL/TM—8950). NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. Order Number DE84008011.

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The research summarized in this report was conducted as part of a program entitled Nuclear Power Plant Entry Level Qualification and Training. A process is developed to assist in the selection of plant malfunctions which should be specifically addressed as part of the training program, and further guidance is given for determining which of those malfunctions should be included in simulator training. Consequences (C), difficulty (D), and frequency (F) rating forms are developed to determine the relative importance of training for any system malfunction. Plant malfunctions were categorized for 46 plant systems. Thirteen of these malfunction categories were then used to demonstrate the C-D-F rating forms. 15 references.

33064 **(NUREG/CR—3600) Data summary report for fission product release test HI-4.** Osborne, M.F.; Collins, J.L.; Lorenz, R.A.; Norwood, K.S.; Travis, J.R.; Webster, C.S. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 69p. (ORNL/TM—9011). NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. Order Number DE84012858.

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The fourth in a series of high-temperature fission product release tests was conducted in which a 20.3-cm-long fuel specimen from the Peach Bottom-2 reactor was heated for 20 min at a maximum temperature of ~ 1850°C in a flowing steam-helium atmosphere. The test specimen was part of a fuel rod which was irradiated to ~ 10.10 MWd/kg. Posttest metallographic examination of the fuel specimen revealed evidence of cladding melting at each of the transverse cuts that were made. Gas analysis during the test indicated that ~ 54% of the cladding was oxidized. Total oxidation did not occur because of the low stream flow which was used. Gamma spectrometry (GS) and neutron activation (NA) analyses of test components revealed the following releases: (1) GS - 21.1% ^{85}Kr, 31.7% ^{137}Cs; and (2) NA - 24.7% ^{129}I. A value of 35.8% cesium release was determined by counting the fuel rod segment before and after the test. If the pellet-clad gap fission gas inventory had also been available for release in the test, the ^{85}Kr release would have been 31.3%. Significant releases of radiogenic Rb, Cd, Ag, and Br, as well as trace amounts of Te, La, Ba, Sr, and Eu, were detected by spark-source mass spectrometric analysis. The masses of materials which were transported by carrier gas to the thermal gradient tube (TGT) and filters from the furnace and test specimen were measured by weighing. The concentrations of vapor and aerosol particulates in the gas stream were calculated from these weights.

33065 **(NUREG/CR—3613) Evaluation and acceptance of welded and repair-welded stainless steel for LWR service. Annual report for 1983.** Atteridge, D.G.; Bruemmer, S.M.; Page, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 55p. (PNL—4941). NTIS, PC A04/MF A01; 1 - GPO $4.50; GPO Dep. Order Number DE84013756.

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Pacific Northwest Laboratory (PNL) is conducting a program to determine a method for evaluating the acceptance of welded and repair-welded stainless steel (SS) piping for light-water reactor (LWR) service. Validated models, based on experimental data, will be developed to predict the degree of sensitization (DOS) and the intergranular stress corrosion cracking (IGSCC) susceptibility in the heat-affected zone (HAZ) of the SS weldments. IGSCC is caused by a combination of a sensitized microstructure, an aggressive environment, and tensile stress. Control of any of these three factors can eliminate IGSCC in most practical situations. This program will measure and model the development of a sensitized microstructure as it pertains to welded and repair-welded SS pipe. An empirical correlation between a material's DOS and its susceptibility to IGSCC will be determined using constant extension rate tests (CERTs). The successful completion of these tasks will result in a method for assessing the effects of welding/repairing parameters on the IGSCC susceptibility of component-specific nuclear reactor welds/repairs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 32716, 33060, 33061, 33062, 33063, 33065, 33212, 33213, 33217, 33218, 33223, 33252, 33253, 33255, 33261, 33262, 33263, 33265, 33266, 33267, 33270, 33274, 33275, 33276, 33284, 33285, 33286, 33287, 33295, 33297, 33303, 33304, 33305, 33306, 33307, 33312, 33316, 33317, 33318, 33319, 33320, 33322, 33323, 33325, 33326, 33327, 33328, 33329, 33331, 33333, 33335, 33336, 33337, 33338, 33339, 33340, 33350, 33353, 33356, 34329

33066 **(BMI—1983-009) Studies for improving PWR simulators and the training of PWR operators using simulators. Pt. 2.** Simon; Meissner; Emmerich; Hirdes; Hanke; Wagner. (Bundesministerium des Innern, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Sep 1983. 357pp. (In German). (GRS-A—841). NTIS (US Sales Only), PC A16/MF A01. Order Number DE84751500.

The survey describes studies on the improvement of a PWR-simulator concerning the simulation of failures and accidents, and how the operating personnel can handle them. Results gained from model tests and/or simulation of transients and accidents are illustrated and explained in detail. The knowledge gained from the evaluation of the results is presented and commented. The studies opened new perspectives for numerous improvements concerning the examined simulator and/or the training of personnel on the simulator. The results show in this survey are to be considered as recommendation for the improvement of PWR-simulators having achieved the same degree of sophistication as KWU's simulator in Karlstein. Recommendations concerning requirements on future simulators are also made. These recommendations are based on the knowledge gained from this study.

33067 **(BMI—1983-025) Consideration of loading conditions initiated by thermal transients in PWR pressure vessels.** Azodi; Glahn; Kersting; Schulz; Jansky. (Bundesministerium des Innern, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Dec 1983. 166p. (In German). (GRS-A—872). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751432.

This report describes the present state of PWR-plants in the Federal Republic of Germany with respect to - the design of the primary pressure boundary - the analysis of thermal transients and

resulting loads - the material conditions and neutron fluence - the requirements for protection against fast fracture. The experimental and analytical research and development programs are delineated together with some foreign R and D programs. It is shown that the parameters investigated (loading condition, crack shape and orientation etc.) cover a broad range. Extensive analytical investigations are emphasized.

33068 **(CEA-CONF—7084) Eddy current testing of PWR fuel pencils in the pool of the Osiris reactor.** Faure, M.; Marchand, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1983. 21p. (In French). (CONF-831175—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751568.

From 6. international conference on nondestructive evaluation in the nuclear industry; Zurich, Switzerland (27 Nov 1983).

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A nondestructive testing bench is described. It is devoted to examination of high residual power fuel pencils without stress on the cladding nor interference with cooling. Guiding by fluid bearings decrease the background noise. Scanning speed is limited only by safety criteria and data acquisition configuration. Simultaneous control of various parameters is possible. Associated to an irradiation loop, loaded and unloaded in a reactor swinning pool, this bench can follow fuel pencil degradation after each irradiation cycle.

33069 **(DLCS—5000483) Shippingport Atomic Power Station. Quarterly operating report, fourth quarter 1983.** (Duquesne Light Co., Shippingport, PA (USA)). 1983. Contract AC11-76PN00292. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008164.

At the beginning of the fourth quarter of 1984, the Shippingport Atomic Power Station remained shutdown for end of life defueling and decommissioning. The reactor pit section of the canal remained full of borated water with the reactor pit gate removed for continued fuel movement. Reactor plant system inactivation and turbine plant salvage operations continued during the quarter and will continue through the first quarter of 1984. Two fuel shipments were made during the quarter: one in October and one in November. The irradiated PWR Core 2 barrel and miscellaneous refueling tools remained in storage under shielding water in the Deep Pit. On-shift casualty and emergency drills were performed during the quarter.

33070 **(EGG-TMI—6536) Plan for shipment, storage, and examination of TMI-2 fuel.** Quinn, G.J.; Engen, I.A.; Tyacke, M.J.; Reno, H.W. (EG and G Idaho, Inc., Idaho Falls (USA); EG and G, Inc., Middletown, PA (USA). Technical Integration Office). May 1984. Contract AC07-76ID01570. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013084.

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This Plan addresses the preparation and shipment of core debris from Three Mile Island Unit 2 (TMI-2) to the Idaho National Engineering Laboratory (INEL) for receipt, storage, and examination. The Manager of the Nuclear Materials Evaluation Programs Division of EG and G Idaho, Inc. will manage two separate but integrated programs, one located at TMI (Part 1) and the other at INEL (Part 2). The Technical Integration Office (at TMI) is responsible for developing and implementing Part 1, TMI-2 Core Shipment Program. That portion of the Plan establishes coordination between TMI and INEL (and others) for shipment of core debris, and it provides the coordination by which handling systems at both locations are designed, constructed, or modified to establish and maintain system compatibility. The Technical Support Branch (at INEL) is responsible for developing and implementing Part 2, Core Activities Program. That portion of the Plan details operational and examination activities at INEL, as well as defines core-related activities planned at other DOE laboratories.

33071 **(EPRI-NP—3275-Vol.1) Causes of denting. Volume 1. Summary report. Final report.** Economy, G.; Wolfe, C.R. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). May 1984. 74p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920391.

This summary report outlines the work that was performed to gain a more complete understanding of denting corrosion of steam generators in PWRs. Background laboratory and plant data on denting were compiled, reviewed and correlated to determine how various exposure conditions affect denting. Two high-temperature chemistry analytical models were reviewed and evaluated by experimental simulation of impurity concentration in the heat transfer and isothermal capsule tests. Simulation of impurity concentration for three cooling waters (lake, river, and cooling tower) was evaluated. The effects of species concentration (Cu^{++}, Cl^{-}, O_2, and H^{+}), contaminant thresholds (established by isothermal and heat transfer tests), and heat flux as indicated by superheat on denting were examined. A discussion of several pertinent observations and conclusions drawn from these tasks (as they pertain to plant operation) is presented.

33072 **(EPRI-NP—3275-Vol.2) Causes of denting. Volume 2. Laboratory test results. Final report.** Economy, G.; Smith-Magowan, D. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). May 1984. 184p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920420.

Denting is the deformation of the alloy 600 heat transfer tubes at tube-tube support plate intersections in some nuclear steam generators. The purpose of this study was to review the results of all Westinghouse dent-related laboratory testing in order to derive correlations between corrosion rates and chemistry, temperature, heat flux, crevice condition, and support plate material. Chemistry considerations are the most significant of these parameters and involve the definition of the level of acid chloride in the crevice. Consideration of the relationship between this concentrated solution and the more dilute bulk environment is also provided. The principal effect of heat transfer is to concentrate, within crevices, nonvolatile contaminants that are present in the bulk. Correlation of denting with heat flux level is influenced by bulk chemistry or local thermohydraulics and thus are difficult to attribute directly to heat flux. Denting increased with temperature. Crevice condition encompassed three variables: width, packing, and shape. A minimum width was found in both isothermal and heat transfer tests, below which denting or bulging was negligible or nonsustainable beyond a marginal extent. The quatrefoil crevice shape required higher heat flux than the drilled shape to produce denting on A285 carbon steel material. Pre-packing crevices with corrosion product oxides did not profoundly alter the denting mechanism, but was adopted mainly to optimize consistency of results. The resistance to denting of different support materials was found to increase with increasing chromium content of the alloy, and 405 SS, in either the drilled or quatrefoil configuration, resisted denting.

33073 (EPRI-NP—3347-SR, pp 33.1-33.10) **Development of a finite element model for eddy current NDT phenomena.** Lord, W. (Colorado State Univ., Fort Collins). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

This work demonstrates that numerical analysis techniques can be applied to the modeling of eddy current NDT phenomena used in the examination of PWR steam generator tubes. Two-dimensional and axisymmetric code was applied to a study of differential eddy current probe impedance plane trajectories for those steam generator geometries which have axisymmetry. In a parallel study two-dimensional and axisymmetric code was developed for studying the magnetostatic fields associated with direct current probes. Work has continued in applying the axisymmetric eddy current code to additional NDT geometries, and in extending the code to the problem of modeling EC probe responses to realistic 3-D defect shapes such as pits and axial cracks. A new parametric signal processing technique, the Fourier descriptor method, has been successfully applied to the problem of classifying differential EC probe impedance plane trajectories.

33074 (EPRI-NP—3347-SR, pp 37.1-37.9) **Evaluation and transfer of steam generator NDE technology.** Brown, S.D. (J.A. Jones Applied Research Co., Charlotte, NC). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

The Center is evaluating various methods which address steam generator NDE problems: electromagnetic methods, alternate eddy current test coils, evaluation of dent profilometry techniques, and methods for detecting support plate ligament cracking.

33075 **(EPRI-NP—3461) Effects of shutdown/cooldown techniques on radiation fields in PWR primary coolant loops.** Bishop, W.N.; Stagg, W.R. (Babcock and Wilcox Co., Lynchburg, VA (USA). Lynchburg Research Center). May 1984. 86p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920390.

Includes 3 sheets of 24x reduction microfiche.

Radioactive corrosion deposited on reactor coolant system surfaces is the primary source of radiation exposure at nuclear power plants. The process of transport, activation and deposition of corrosion products involves the solubility of the corrosion products. The effect of redox agents, pH and temperature on the solubility of corrosion products was studied. The solubility of the corrosion products was calculated from thermodynamic properties. These calculations included the effects of redox agents, pH and temperature. These calculations showed that control of redox agents and pH could minimize the solubility of corrosion products during the shutdown/cooldown of nuclear plants. Based on the calculations, plant tests were conducted to demonstrate the feasibility of solubility control during shutdown. The results showed that corrosion product solubility can be controlled by a combination of redox and pH control techniques.

33076 **(EPRI-NP—3488) Fuel failures in the Connecticut Yankee reactor (Haddam Neck). Addendum to NP-2119.** Raven, L.F.A.; Howl, D.; Naylor, J.; Pitek, M.T.; Clink, L.J. (Northeast Utilities Service Co., Hartford, CT (USA)). May 1984. 52p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920415.

Significant levels of fuel rod failures were observed in the batch 8 fuel assemblies of the Connecticut Yankee reactor. Results of detailed poolside and hot cell examinations, reported earlier in NP-2119, indicated the failure mechanism was stress corrosion cracking initiating on the clad outer surface. The sources of cladding stresses were believed to be (a) fuel pellet chips wedged in the cladding gap, (b) swelling of highly nondensifying batch 8 fuel, and (c) potentially harmful effects of a power change event that occurred near the end of the second cycle of irradiation for batch 8. This report reviews the 1977-78 experience and conclusions of the earlier investigations against the background of the total operational experience of the reactor from initial startup to the present time. It provides more details on operating conditions and uses the results of SLEUTH-SEER analyses to interpret the effects of operational maneuvers. The investigation adds more evidence for the importance of the ramp effects.

33077 (IAEA-SMR—68/2, pp 1-55) **Fundamentals of pressurized water reactors.** Murray, L. (North Carolina State Univ., Raleigh (USA). Dept. of Nuclear Engineering). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

In many countries, the pressurized water reactor (PWR) is the most widely used, even though it requires enrichment of the uranium to about 3% in U-235 and the moderator-coolant must be maintained at a high pressure, about 2200 pounds per square inch. The objective in this series of seven lectures is to describe the design and operating characteristics of the PWR system, discuss the reactor physics methods used to evaluate performance, examine the way fuel is consumed and produced, study the instrumentation system, review the physics measurements made during initial start-up of the reactor, and outline the administrative aspects of starting up a reactor and operating it safely and effectively.

33078 (IAEA-SMR—68/2, pp 57-70) **Fundamentals of WWER-type pressurized water reactors.** Silvennoinen, P. (Technical Research Centre of Finland, Nuclear Engineering Lab., Helsinki). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

The brief series of lectures cover the fundamentals of the Soviet pressurized water reactors (WWER) including a discussion on core layout and lattice design as well as on loading patterns of the WWER-440. Special features of the calculational procedures are described and examples are given of lattice cell, power distribution and core dynamics calculations. Finally, some remarks are made on the new WWER-1000 core design.

33079 (IAEA-SMR—68/2, pp 215-278) **Operational physics of pressurized water power reactors.** Bosser, R. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Dept. des Reacteurs a Eau). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

These lectures are about the physics of pressurized water power reactors. They mainly refer to the 900MWe Westinghouse reactor type; with a view to illustrating the real problems that occur on largely built and operating plants. Nevertheless, however, general questions common to all PWRs are also developed. A brief review of the power operation conditions including the utilities needs, the technical and safety limits, and the physical parameters measured to operate the reactor in a safe, reliable and efficient manner intends to introduce the origin of the problems. The measurement devices relative to the flux (power, reactivity), temperature, pressure, mass flow, boron, concentration are described in detail and the trend of development in this field is presented. Core calculations are discussed, not in detail as design calculations but more as support to the analysis of the experimental measurements. The start-up tests are described in detail in chronological order from fuel loading to full power. They include the hot zero power and the power tests. The last part concerns some operation problems such as reactor transients (the Xenon effect is developed) and load following. This work was intended to support an oral presentation of the subject and not to be self-explanatory as a written course.

33080 (INIS-BR—120, pp 114-115) **Quality control for zircaloy tubes.** Silva, B.F. da; Lamy, C.A.; Alves, P.R. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33081 (INIS-BR—120, pp 225-228) **Implantation and developemnt of computer codes.** Sato, E.F. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33082 (INIS-mf—8928, pp 152-165) **Critical review of use of high pressure saturated steam turbine economizers in nuclear power plants.** Urbanek, J. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780241. (CONF-8112102—Vol.1).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

In the high-pressure part of the turbine drops of moisture condensate, which causes erosion and has negative impact on the service-life of the turbine and on its thermodynamic efficiency. Various designs have been put forward to eliminate moisture. A good combination is moisture separation combined with the offtake of steam for the regeneration of feed water or for the steam reheater. As concerns the high-pressure component of the turbine it is best to offtake steam for the feed water heater and for heating the steam between the high- and low-pressure components of the turbine. The connections of the heater and re-heater in diagrams of various manufacturers are evaluated and compared. It appears to be uneconomical to use the heater in cases where feed water would be heated to temperature considerably below its optimal value. (M.D.).

33083 (INIS-mf—8929, pp 192-202) **Pressure and leak testing of containments and sealed spaces.** Csekey, L.; Loerincz, J.; Markus, J. (Vyskumny Ustav Energetickych Zariadeni Brno, Pracovisko Tlmace (Czechoslovakia)). 1981. (In Slovak). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780242. (CONF-8112102—Vol.2).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The basic methods are described of strength tests, initial and final integral leak tests and local leak tests. Methods are presented of processing the measured data and of measuring the size of leakage, and the apparatus used and the general rules related to the number and distribution of sensors inside the containment are dealt with. A brief description is presented of methods of local leak tests: the method of pressure drop, the method of bubble overpressure, the bubble vacuum, vacuum, halogen, helium and adhesive dye methods. (M.D.).

33084 (INIS-mf—8929, pp 162-173) **Calculation of strength and life of WWER steam generator and pressurizer.** Vejvoda, S.; Vykutil, J.; Moulis, R.; Markus, J. (Vitkovice Koncern, Ustav Aplikovane Mechaniky, Brno (Czechoslovakia)); Kotarba, J. (Vitkovice, Ostrava (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780242. (CONF-8112102—Vol.2).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

Desk computer HP 9845 A was used to compute models of construction assemblies with complicated shapes and their boundary conditions. The question is discussed of application of the finite element method to determine the state of stress of the body, and the determination of accuracy of the shape coefficient using the finite element method is dealt with. A method is suggested of simplified evaluation of fatigue. (M.D.).

33085 (INIS-mf—8930, pp 141-150) **VOR programe package for calculating hydraulic shock in generally branched coolant circuit.** Kodl, P. (Skoda, Plzen (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780245. (CONF-8112102—Vol.3).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

Using program VOR 1 it is possible to make steady-state hydraulic calcualtions of a generally branched pipe network. This program is used to solve initial conditions for the actual non-steady state calculation of hydraulic shock using program VOR 2. The physical flow model is one-dimensional, single-phase, pressure losses are concentrated at points of fictitious diaphragms. For numerical solution, the fictitious diaphragm method is used, which is an analogy of the graphic Schnyder-Bergeron method and the method of characteristics. A failure due to a shock may be modeled by changes in pressure, flow rate and the adjustment of the fitting at any arbitrary point in the circuit. The calculation will determine the time course of the pressure and flow rate at all points in the circuit. Selected as an example was seizing of the main circulating pump in one branch of the WWER primary circuit. (B.S.).

33086 (INIS-mf—8930, pp 178-190) **Critical heat flows in light water reactor fuel elements.** Vympola, J.; Kostalek, J. (Statni Vyzkumny Ustav pro Stavbu Stroju, Bechovice (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780245. (CONF-8112102—Vol.3).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

An empirical correlation is presented for the computation of critical thermal flow densities derived from own measurements on models with axially even and radially even and uneven heat generation. The results are presented tested on a sample of published experimental data and correlations presented in the literature are critically evaluated. The correlation also includes the influence of axially uneven heat flow distribution on departure nucleate boiling and the measure of safety is given for the rated parameters of the WWER 1000 reactor. (J.B.).

33087 **(KFK—3658) FEBA - flooding experiments with blocked arrays. Data report 1, test series 1 through 4.** Ihle, P.; Rust, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Mar 1984. 547p. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.).

This report presents typical data and a limited heat transfer analysis of test series 1 through 4 from an experimental thermal-hydraulic program of Flooding Experiments with Blocked Arrays (FEBA). The experiments consisted of separate effect tests on a full-length 5 x 5 rod bundle of PWR fuel road dimensions utilizing electrically heated rods with a cosine power profile approximated by 7 steps of different specific power. Eight test series were performed under idealized reflood conditions using forced feed and system pressure as parameters without the inclusion of the effects of a reactor cooling system. This individual test series were conducted to study the effect of grid spacers and of coplaner blockages of different blockage ratios with and without bypass on the reflood heat transfer. The purpose of the investigations was to obtain an insight into the most important heat transfer mechanisms and to broaden the data base for the development and assessment of improved thermal-hydraulic models.

33088 **(NNC—01) Statement for Sizewell 'B' public inquiry.** (National Nuclear Corp. Ltd., London (UK)). Jul 1982. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702035.

The formation of National Nuclear Corporation Limited (NNC) is discussed together with its acquisition of staff with nuclear experience, the main contracts which it has performed or is performing, its present corporate structure and the organisation by projects and functions through which it discharges its current obligations. Information concerning NNC's experience in water reactor design and technology, its most recent contribution to assist the Government in making its decisions with respect to the type of reactor upon which the UK nuclear programme should be based, technical agreements it has reached with US organisations, the nature of the work on Sizewell B which is currently being done and the arrangements made for doing it, the implications of building Sizewell B on export prospects and on industry, and NNC's planning to anticipate the possible future requirements for PWR power stations is provided.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 32654, 33062, 33117, 33118, 33767

33089 **(GA-A—17559) Kernel migration in failed, oxide-based HTGR fuel.** Montgomery, F.C.; Partain, K.E.; Allen, H.C. (GA Technologies, Inc., San Diego, CA (USA)). May 1984. Contract AT03-84SF11962. 12p. (CONF-840614—60). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013344.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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Oxide-based HTGR fuel particles with artificially failed coatings have been heated in the range 1100° to 1350°C (1273 to 1623 K) to investigate the interaction of the kernel with its surrounding coating. At these temperatures, oxide-based kernels in failed TRISO-coated particles migrate due to the reaction of the oxide kernel with the surrounding carbonaceous layers. The rate of kernel migration is dependent on the time of reaction, the temperature, and the CO pressure. The temperature dependence of the migration rate suggests that migration is controlled by diffusion of oxygen across the carbide product layer. Adding CO to the cover gas reduces the rate of migration and can prohibit migration if the CO pressure exceeds the thermodynamic equilibrium value for a given reaction temperature. Because complete conversion of the oxide kernel to carbide occurs within the particle, migrating oxide-based kernels do not penetrate the silicon carbon (SiC) coating in TRISO particles. Thus, propagating particle failure caused by kernels that have breached their coatings reacting with the outer coatings of adjacent particles will not occur in the reference particle at normal high temperature gas-cooled reactor (HTGR) operating temperatures.

33090 **(ORNL/TM—8922) Regarding overrelaxation for accelerating an iteration process.** Vondy, D.R. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013626.

The solution for a vector that satisfies a set of coupled equations is often obtained economically in iteration. Application of an overrelaxation coefficient to augment the calculated iterate changes is done to accelerate the rate of convergence. This scheme is simple to implement and often effective. Much is known theoretically about the iterative behavior when the system of equations is linear, although there are complexities that are not widely known. Extensive use is made of the scheme even to non-linear systems of equations where behavior depends on the situation. Of much concern to the developer of solution methods (typically an engineer or applied mathematician) is implementing an effective procedure at a modest investment in development and testing. Applications are described to thermal cell and neutron diffusion modeling.

33091 **(RD/B/N—1500) Environmental influences on fuel burnup in Mk.III G.C.R.'s.** Ainger, P.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Sep 1969. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84901356.

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An area of an equilibrium Mk.III G.C.R. core has been represented by a non-leaking supercell to examine the effect which the environment has upon the macroscopic neutron properties of the fuel. Comparisons have been made between the results of this calculation and the WIMS output with regard to variations in k ∞, rating and fast neutron damage over the fuel lifetime. The feedback effects of this environment on the changes in isotopic composition of the fuel as a function of irradiation have been examined. It is found that at any point in time most parameters of interest are significantly affected by this feedback but that when these quantities are averaged over lifetime this sensitivity is very much reduced. A theoretical explanation of this effect is included. Good agreement was obtained between reactor calculations in 2 and 9 energy groups for the irradiated supercell.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

33092 (IAEA-SMR—68/2, pp 131-214) **Fundamentals of CANDU reactor nuclear design.** Pasanen, A.A. (Atomic Energy of Canada Ltd., Engineering Co., Mississauga, Ontario). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

A physical description of a CANDU reactor of the 600 MWe size is given, with particular emphasis on the core design and nuclear performance characteristics. The methodology used in the physics analysis associated with the design process is outlined, and typical results of the analysis presented. Finally, the determination of the initial fuel load is described and the physics analysis and tests associated with commissioning are summarized.

33093 (IAEA-SMR—68/2, pp 451-525) **CANDU-PHW fuel management.** Frescura, G.M.; Wight, A.L. (Nuclear Studies and Safety Dept., Ontario Hydro, Toronto (Canada)). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

The report deals with fuel management in natural uranium fuelled CANDU-PHW reactors. Assuming that the reader has a basic knowledge of CANDU core physics, some of the reactor systems which are more closely related to fueling are described. This is followed by a discussion of the methods used to calculate the power distribution and perform fuel management analyses for the equilibrium core. A brief description of some computer codes used in fuel management is given, together with an overview of the calculations required to provide parameters for core design and support the accident analysis. Fuel scheduling during approach-to-equilibrium and equilibrium is discussed. Fuel management during actual reactor operation is discussed with a review of the operating experience for some of the Ontario Hydro CANDU reactors.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 32700, 33220, 33251, 33254, 33256, 33257, 33269, 33271, 33272, 33277, 33278, 33279, 33280, 33281, 33291, 33292, 33293, 33294, 33322, 33342, 33348, 33352, 33355, 33357

33094 **(HEDL-SA—3019-S) Modeling delayed neutron monitoring systems for fast breeder reactors.** Bunch, W.L.; Tang, E.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 4p. (CONF-840614—65). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013939.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

The purpose of the present work was to develop a general expression relating the count rate of a delayed neutron monitoring system to the introduction rate of fission fragments into the sodium coolant of a fast breeder reactor. Most fast breeder reactors include a system for detecting the presence of breached fuel that permits contact between the sodium coolant and the mixed oxide fuel. These systems monitor for the presence of fission fragments in the sodium that emit delayed neutrons. For operational reasons, the goal is to relate the count rate of the delayed neutron monitor to the condition of the breach in order that appropriate action might be taken.

33095 **(HEDL-SA—3049) N-47 postprocessor for high temperature inelastic analyses.** Hubel, H.; Weiner, E.O. (Hanford Engineering Development Lab., Richland, WA (USA); Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). 1984. Contract AC06-76FF02170. 11p. (CONF-840831—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006352.

From ASME international computers in engineering conference; Las Vegas, NV, USA (12 Aug 1984).

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A computer program, CPROC, has been designed to conduct high temperature evaluations of inelastic strain and creep-fatigue damage accumulations per T-1310 and T-1420 of the ASME N-47 code case. A sequential data base, generated by an inelastic analysis with a finite element program, is read in a single pass. Currently, the data base may be created with the POST option or the ELEVAR user routine in the MARC finite element system. The assumed data base structure is general enough to admit most MARC element types. Adjustments may be made for missing direct stress components, a situation common to shell and beam elements. Reading of an ADINA PORTHOLE data base is possible. Also, small problems without a data base may have the necessary data input directly by the user. User input includes section definitions and fatigue cycle definitions. Stress rupture and fatigue data may be entered by the user, or built-in data for 304SS and 316SS may be invoked. Section strains and creep-fatigue damage values are printed at user-specified places and time, and end-of-life extrapolations are performed. A negative design margin summary is provided. An option is provided for printing stress and strain components. Almost any printed variable may be plotted with linear or logarithmic axis.

33096 (INIS-BR—120, pp 192) **Neutronic calculation on LMFBR (1250 MWe) benchmark model.** Bastos, W.S. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33097 (INIS-BR—120, pp 192-193) **Neutronic calculations on the sodium void coefficient.** Waintraub, M. (Rio de Janeiro Univ. (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33098 (INIS-BR—120, pp 205-206) **Operation, maintenance and modifications in the sodium thermal loop - CTS-1.** Bellini, I.W.; Silva Porto, F.G. da; Walsh, L.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)) (and others). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33099 (INIS-BR—120, pp 240 p.) **Project of diffusion cold trap for CTS-1.** Araujo, F.G.B. de; Moura, N.R. de; Cunha Simao, J.C. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33100 (INIS-BR—120, pp 209-210) **Possibilities evaluation of sodium simulation with the water loop.** Castro Moreira, L.Q. de; Sampaio, P.A.B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33101 (INIS-BR—120, pp 116) **Materials for fast reactors.** Astuto, A.; Tanajura, C.A.S.; Folescu, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33102 (INIS-BR—120, pp 190-191) **Core project of a low power fast reactor : introduction to a new methodology of calculation and preliminary results.** Jachic, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33103 (INIS-BR—120, pp 213-214) **Elastoplastic bending of great displacements of primary sodium safety reservoir for PEC reactor.** Jesus Miranda, C.A. de; Bezerra, L.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33104 (INIS-BR—120, pp 214) **Elastic analysis of the grid where the PEC reactor fuel elements are supported.** Jesus Miranda, C.A. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33105 (INIS-BR—120, pp 222) **Thermohydraulic simulation models of steam generators heated with sodium.** Cavalcanti, V.L.; Botelho, D.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33106 (INIS-BR—120, pp 222-223) **Calculations of pressure drop and redistribution of rate of flow in LMFBR reactor core.** Botelho, D.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33107 (INIS-BR—120, pp 230-231) **Study on the production, elimination and quality of sodium smoke.** Goncalves, A.C. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33108 (INIS-BR—120, pp 27-28) **1DXB and GENERATOR computer codes.** Leal, L.C.; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33109 (IWGFR—43, pp 11-22) **Position paper of the Federal Republic of Germany on sodium fires, design and testing.** Jordan, S.; Peppler, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)); Oeynhausen, H.; Freudenstein, K.F. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Jan 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780439. (CONF-820590—Summ.).

From International working group on fast reactors specialists' meeting on sodium fires, design and testing; Richland, WA, USA (24 May 1982).

A substantial part of the research and development work is correlated to the containment concept. The safe operation of the containment with its main components has to be shown by containment analysis and some experimental work under accident conditions. The results of the aerosol physical and thermodynamic analysis are discussed with regard to their importance for the experimental parameters.

33110 (IWGFR—43, pp 43-47) **Japanese studies on sodium fires, design and testing.** Mitsutsuka, N.; Yoshida, N. (Fast Breeder Reactor Development Project, Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Jan 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780439. (CONF-820590—Summ.).

From International working group on fast reactors specialists' meeting on sodium fires, design and testing; Richland, WA, USA (24 May 1982).

Considerations of sodium fires are very important for the design and licensing of LMFBRs. Continuing effort has been made in the study of sodium fires and their consequences since the beginning of the Japanese fast breeder reactor development program. Recent effort is mainly focussed on studies related to Monju, especially on the design and testing of primary cell liners against large sodium spills. Experimental and analytical studies on sodium fires, water release from concrete and sodium concrete reactions are conducted as a part of this study. Some extinguishing agents are also tested against sodium fires. In addition, considerable effort is being made in the development of detection systems for the small sodium leaks before a pipe rupture. This paper briefly summarizes the Japanese status of these sodium fire related activities conducted by Fast Breeder Reactor Development Project of the Power Reactor and Nuclear Fuel Development Corporation (PNC).

33111 (JAERI-M—83-050) **Single-fluid-type accelerator molten-salt breeder (AMSB).** Furukawa, Kazuo; Tsukada, Kineo. (Japan Atomic Energy Research Inst., Tokyo). Mar 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702036.

The applications of molten-salt target and blanket to the Accelerator Molten-Salt Breeder (AMSB) are discussed, where the molten fluorides including ThF_4 or UF_4 in high concentration are utilized. This concept naturally has several significant benefits relating to the target fabrication, design, radiation damage, heat removal, safety, and economy. Until now, a poor spallation neutron yield was mentioned as a severe fault. However, according to the results of neutronics calculation performed on the molten-salt system such as LiF-BeF_2-ThF_4, LiF-NaF-ThF_4, LiF-BeF_2-UF_4 etc., their neutron yields have been found comparable with or superior to the values for heavy metal target such as Bi and Pb, assuring the high performance of AMSB. The schematic figures of AMSB are shown together with the several tables and figures of their neutronics calculation models, neutron yields, and predicted performances. Neutronics calculations have been performed with the use of NMTC/JAERI modified to include fission processes, TWOTRAN-II and other auxiliary codes. The spatial and energy distributions of neutrons have been also calculated. The chemical aspects of spallation products in these facilities have been examined and are believed to be practically manageable in processing. The energy strategical positions of AMSB have been discussed, one of which is the application for producing ^{233}U fuels. This may contribute to the early initiation of self-sustaining Th fuel cycle.

33112 (LA—10036-PR) **Examination of fast reactor fuels and FBR analytical quality-assurance standards and methods. Progress report, October 1-December 31, 1983.** Wood, W.T. (comp.). (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014142.

Reported are: equipment development, analytical chemistry, examination of irradiated materials, quality assurance, and quality-assurance materials for SAF (Secure Automated Fabrication) facility. (DLC)

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

33113 (CONF-840570—8) **Fuel system and structural alloy considerations for space nuclear reactor systems.** Hoffman, E.E.; Cooper, R.H. Jr. (USDOE Oak Ridge Operations Office, TN; Oak Ridge National Lab., TN (USA)). 3 May 1981. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012328.

From Materials for future energy systems conference; Washington, DC, USA (1 May 1984).

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Sufficient data exist to provide a high level of confidence that refractory-alloy-clad ceramic fuel pins and refractory structural alloys can be used successfully in an operational space power system. However, data are not yet sufficient to ensure that these materials can meet the temperature, lifetime, and system mass envelope requirements for reliable operation of a 100 kW(e) system as specified by the SP-100 Project. Development efforts to provide these data are being initiated.

33114 (LA-UR—84-1480) **Low power unattended defense reactor.** Kirchner, W.L.; Meier, K.L. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840804—19). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012641.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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A small, low power, passive, nuclear reactor electric power supply has been designed for unattended defense applications. Through innovative utilization of existing proven technologies and components, a highly reliable, walk-away safe design has been obtained. Operating at a thermal power level of 200 kWt, the reactor uses low enrichment uranium fuel in a graphite block core to generate heat that is transferred through heat pipes to a thermoelectric (TE) converter. Waste heat is removed from the TEs by circulation of ambient air. Because such a power supply offers the promise of minimal operation and maintenance (O and M) costs as well as no fuel logistics, it is particularly attractive for remote, unattended applications such as the North Warning System.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 33221, 33344, 33449

33115 (NUREG—0748-Vol.4-No.4) **Operating reactors licensing actions summary. Vol.4, No. 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jun 1984. 388p. NTIS, PC A17/MF A01 - GPO*. Order Number DE84901370.

The operating reactors licensing actions summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors.

2108 Economics

REFER ALSO TO CITATION(S) 33060

33116 **Imposing specific directives on the Bonneville Power Administration. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, First Session, on S. 1701, August 3, 1983.** Washington, DC; Government Printing Office (1984). 539p.

Hearings in Seattle and Washington, DC considered S. 1701 (identical to section 317 of H.R. 3363) relating to the Washington Public Power Supply System (WPPSS) No. 1, 2, and 3 units. The bill clarifies the Bonneville Power Administration's (BPA's) authority to seek alternative financing for construction and states the limitations for seeking public funds through appropriations or municipal bonds. Seventy witnesses presented the views of state officials, utilities, consumers, industry, and labor. Of particular concern were the possibilities of bankruptcy and unemployment for Washington State. The hearing record includes the text of S. 1701, the testimony, and additional material submitted for the record.

2109 Process Heat Reactors

33117 **(GA-A—17495) Modular reactor: a deployment strategy for the long-term HTGR goal of very high temperature operation.** McDonald, C.F. (GA Technologies, Inc., San Diego, CA (USA)). Apr 1984. Contract AT03-76SF70046. 9p. (CONF-840804—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011154.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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From the onset of high temperature gas-cooled reactor (HTGR) activities in the 1950s, the ultimate application of very high temperature operation for process heat use was recognized. It was clear, however, that reactor operation, perhaps as high as 1000°C (1832°F), could only evolve from plant operational experience at steam cycle conditions of 700°C (1292°F), together with the development of materials and components for elevated temperature service. When developed, it is projected that the very high temperature reactor (VHTR) will meet the needs of the synthetic fuel industry in the early decades of the 21st century. This paper highlights an orderly deployment strategy for advancing from an established reactor technology base to VHTR operation. 18 references.

33118 **(GEFR—00691) High temperature gas-cooled reactor program. Advanced systems concepts design and technology development plan.** (General Electric Co., Sunnyvale, CA (USA). Advanced Nuclear Technology Operation). Sep 1983. Contract AC03-80ET34034. 263p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84013566.

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This document provides the Design and Technology Development Plan for the two Modular Reactor Systems (MRS) being studied: a HTGR-MRS-Reformer system to convert methane gas to synthesis gas (H_2 and CO) and also generate electric power, and an HTGR-MRS-Steam Cycle system to supply direct steam for electric power generators and/or process heat. The specific systems addressed by this plan consist of reactor fuel, reactor system, lower vessel, upper vessel reformer, upper vessel steam cycle, and the balance of plant. Base technology areas addressed are reformer catalyst, coolant chemistry, materials, and safety and licensing.

22 NUCLEAR REACTOR TECHNOLOGY

33119 **(INIS-mf—8974) NEA activities in 1982.** (Nuclear Energy Agency, 75 - Paris (France)). 1983. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702052.

Also published in French.

This report presents an account of the activities of the Nuclear Energy Agency. It deals with current nuclear trends, nuclear development and the fuel cycle, nuclear safety research and licensing, radiological and environmental impacts of nuclear fuel cycle activities, legal affairs, nuclear science, joint undertakings, and organization and administration.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 33196

33120 **(EPRI-NP—3489) Validation of resonance-shielding procedures for reactor cell analysis.** Rothenstein, W. (Technion-Israel Inst. of Tech., Haifa. Dept. of Nuclear Engineering). May 1984. 49p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920417.

A special procedure has been developed to determine the effect of the OZMA transport calculations on the EPRICELL results. It consists of matching the OZMA resonance reaction fractions within EPRICELL by iteratively adjusting the EPRICELL cross sections. The resulting group cross sections and integral parameters can be compared directly with the ones calculated by the standard EPRICELL treatments. Benchmark calculations have been made with both codes. Results are compared in the report and discussed both as regards the information they yield about the adequacy of the EPRICELL resonance treatment and in connection with the extent to which OZMA results can be used to formulate empirical corrections to this treatment in the individual resonance groups. Good overall agreement was obtained between the EPRICELL and OZMA results in the epithermal resonance groups, when options developed for using the ENDF/B-V library within EPRICELL are utilized.

33121 (INIS-BR—120, pp 177) **Solution of one-dimensional multigroup - diffusion equation by Fourier series with a few terms.** Oliveira, C.R.E. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33122 (INIS-BR—120, pp 178) **Approximation procedures for the angular variable in neutronic distribution.** Jachic, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33123 (INIS-BR—120, pp 178-179) **Approximation procedures for the energy variable in neutronic distribution.** Jachic, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33124 (INIS-BR—120, pp 179) **Approximation procedures for the spatial variable in neutronic distribution.** Jachic, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33125 (INIS-BR—120, pp 190) **System of neutronic calculation for nuclear reactors.** Assis, J.T. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33126 (INIS-BR—120, pp 191) **Neutron spectral calculation in fundamental method for fast reactors - comparative analysis between differents methodologies.** Reis Filho, P.E.G. dos (Instituto de Engenharia Nuclea., Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33127 (INIS-BR—120, pp 194-195) **Modular system for sensitivity calculations and cross sections adjustments.** Renke, C.A.C.; Santo, A.C.F. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33128 (INIS-BR—120, pp 201) **Determination of bakelite total cross sections in function of the calcination degree.** Voi, D.L.; Brito Aghina, L.O. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33129 (INIS-BR—120, pp 57) **Data analysis.** Antunes, L.J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33130 (INIS-BR—120, pp 26) **LEOPARD and SPOTS computer codes.** Silva, C.F. da; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33131 (INIS-BR—120, pp 27) **HAMMER, LITHE and HELP computer codes.** Leal, L.C.; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33132 (INIS-BR—120, pp 27) **EXTERMINATOR - 2 computer code.** Leal, L.C.; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33133 (INIS-BR—120, pp 28) **KERNELBUT computer code.** Leal, L.C. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33134 (INIS-BR—120, pp 28-29) **ALVIN computer code.** Silva, C.F. da; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33135 (INIS-BR—120, pp 31-32) **Synthesis method with finite elements for three-dimensional diffusion multigroup calculations.** Silva, C.F. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33136 (INIS-BR—120, pp 193) **Presentation and user's manual of ONED computer code.** Assis, J.T. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33137 (INIS-BR—120, pp 193-194) **RMAT 1D computer code. Implantation and user's code.** Assis, J.T. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33138 (INIS-BR—120, pp 194) **Presentation and user's manual of GAMTEC-II computer code.** Assis, J.T. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33139 (INIS-BR—120, pp 194) **ANISN - Presentation and user's manual.** Bastos, W.S. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33140 **(INIS-BR—120) Annual Progress Report of 1982.** (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. 240 p.p. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780396.
The researches programs developed at IEN (Instituto de Engenharia Nuclear) during the year of 1982, are described. Researches are developed in the field of Reactor Physics, Radiation Protection, Chemistry, Nuclear Power Plants, Materials and Metallurgy, Instrumentation and Control. (E.G.).

33141 **(PB—84-169606) Continued development of the QUANDRY code. Final report.** Henry, A.F.; Finck, P.; Joo, H.S.; Khalil, H.; Parsons, K. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jan 1984. 69p. (MIT/EL—84-001). NTIS, PC A04/MF A01.
Sponsored in part by Consolidated Edison Co. of New York, Inc., New York, Northeast Utilities Service Co., Hartford, CT., Pacific Gas and Electric Co., San Francisco, CA., and Public Service Electric and Gas Research Corp., Newark, NJ.
The general goal of the work carried out has been to develop and test a method for predicting detailed power history throughout the lifetime of a light water moderated power reactor. The authors have based the scheme on the two-group nodal code QUANDRY, and the present work has been concerned with testing and refining that code so that it can be used to predict accurate values for local fuel-pin power throughout reactor lifetime in a straightforward, economical manner.

33142 **(UTRCN-G—11) Report of progress of research by common use of facilities in JAERI, 1981.** (Tokyo Univ. (Japan). Research Center for Nuclear Science and Technology). 1982. 401p. (In Japanese). NTIS (US Sales Only), PC A18/MF A01. Order Number DE84702050.
In fiscal 1981, the common utilization of the facilities in the Japan Atomic Energy Research Institute with universities has achieved spectacular results by the efforts of those concerned. This report is published by collecting these results. The role of universities in the society is to train personnel and to do pioneering and fundamental research. In order to establish the total system of atomic energy having safety, reliability and economic efficiency, much more research and development are required. This is being pursued by the cooperative efforts of JAERI and universities. In order to develop this common utilization of facilities further, the expansion of research program to neutron diffraction and the irradiation experiment on living system, the increase of traveling expense for researchers, the expansion of the building for the common utilization, and the increase of managing personnel are necessary. The results of general research and cooperation research are reported.

33143 **Generalized quasi-static method for nuclear reactor space-time kinetics.** Devooght, J.; Mund, E. (Universite Libre de Bruxelles, Service de Metrologie Nucleaire Avenue Franklin Roosevelt, 50, B-1050, Bruxelles). *Nuclear Science and Engineering;* **76**: No. 1, 10-17(Oct 1980).
A generalization of the classical quasi-static method is described. "Amplitude" and "shape" functions are treated on the same footing by applying an iterative Newton method to the integral form of the multigroup diffusion equations. Provision is made for one amplitude function per neutron group. It is shown, further, how this model encompasses Ott and Meneley's improved quasi-static algorithm.

33144 **Comparison of the order of approximation in several spatial difference schemes for the discrete-ordinates transport equation in one-dimensional plane geometry.** Lee, S.M.; Vaidyanathan, R. (Reactor Research Centre, Kalpakkam Tamil Nadu). *Nuclear Science and Engineering;* **76**: No. 1, 1-9(Oct 1980).
A systematic comparison has been made of the local difference operator approximation in spatial difference schemes for the solution of the transport equation in slab geometry by the method of discrete ordinates. The truncation error in different schemes varies according to the nature of the intra-mesh source and flux interpolation, and this explains the good performance of certain recently proposed schemes. The authors have classified the schemes according to the nature of the intra-mesh source interpolation. As a general principle, they find that in each class, the scheme that conserves the spatial moments of source calculated from the previous iteration and avoids flux interpolation is the most accurate.

33145 **Homogenized diffusion approximations to the neutron transport equation.** Larsen, E.W.; Hughes, R.P. (University of California, Los Alamos Scientific Laboratory Theoretical Division, Los Alamos, New Mexico 87545). *Nuclear Science and Engineering;* **73**: No. 3, 274-285(Mar 1980).

A general problem of time-dependent neutron transport in a spatially heterogeneous medium is analyzed by two perturbation methods that have previously been applied to specialized problems. These "bucking" and "asymptotic" methods are shown to be equivalent in the sense that the asymptotic method leads to a time-dependent diffusion equation with constant coefficients, whereas the buckling method leads to the corresponding dispersion law. Two applications, the calculation of k /SUB eff/ , and the derivation of a point reactor model are given. Also, the general results obtained here are shown, in several special cases, to reduce to the simpler results obtained previously.

33146 **Comments on higher order generalized perturbation theory.** Gandini, A. (Comitato Nazionale per l'Energia Nucleare Casella Postale 2358, Rome). *Nuclear Science and Engineering;* **73**: No. 3, 289-294(Mar 1980).

Higher order generalized perturbative formulations are derived in relation to linear functionals for systems at generally non-stationary conditions, starting from perturbative expressions of the density function. Formulations relevant to stationary shielding problems are finally simply obtained as particular cases.

33147 **Time-dependent generalized perturbation theory for coupled neutron-nuclide problems.** Greenspan, E.; Marable, J.H.; Williams, M.L. (Oak Ridge National Laboratory Engineering Physics Division, P.O. Box X Oak Ridge, Tennessee 37830). *Nuclear Science and Engineering;* **73**: No. 2, 210-218(Feb 1980).

A generalized time-dependent nonlinear perturbation theory for coupled fields of neutrons, nuclides, and delayed neutron precursors is presented in a unified, yet detailed, formulation for diverse areas of applications, including depletion analysis, xenon poisoning, reactor kinetics, and pulsed neutron problems. Several applications of this formulation are discussed including cross-section sensitivity analysis and reactor design and operation sensitivity analysis.

33148 **A rigorous treatment of transverse buckling effects in two-dimensional neutron transport computations.** Blomquist, R.N.; Lewis, E.E. (Northwestern University, Nuclear Engineering Program, The Technological Institute Evanston, Illinois 60201). *Nuclear Science and Engineering;* **73**: No. 2, 125-139(Feb 1980).

The variational formulation of the even-parity form of the within-group neutron transport equation is generalized to include complex trial functions. The introduction of transverse leakage effects through the buckling term exp(iB X r) leads, in general, to a coupled set of Euler equations for the real and imaginary even-parity flux components. The coupling between real and imaginary flux components is retained in both discrete-ordinates and finite element angular approximations. Employment of the spherical harmonics approximations in angle, however, leads to an uncoupled set of Euler equations if an appropriate choice of axes is made. Hence, a rigorous buckling treatment of third-dimensional leakage can be incorporated into two-dimensional transport computations without solving for the imaginary flux component. The foregoing spherical harmonic formulation is combined with finite element discretization in space in the multigroup criticality code FESH. One- and multigroup results are presented to demonstrate the elimination of ray effects and to examine the errors introduced by the DB^2 leakage correction used in conventional transport calculations.

33149 **Neutron spectra from monoenergetic source neutrons after multiple reflection between plane-parallel concrete interfaces.** Hagan, W.K.; Simmons, G.L. (Science Applications, Inc. 1200 Prospect Street La Jolla, California 92038). *Nuclear Science and Engineering;* **73**: No. 1, 35-41(Jan 1980).

Monte Carlo calculations have been performed for neutrons reflecting between two Type 04 concrete plane-parallel interfaces. A new 23-group albedo data base (SAIL) was used in conjunction with the MORSE code to calculate the neutron spectrum at each reflection. It was found that, after thermalization, for the same order of reflection, the number of neutrons in the cavity is dependent on the initial energy of the neutrons. Typical results are presented along with a brief history of the motivations for these calculations.

33150 **Convergence rates of spatial difference equations for the discrete-ordinates neutron transport equations in slab geometry.** Larsen, E.W.; Miller, W.F. (University of California, Los Alamos Scientific Laboratory, Theoretical Division P.O. Box 1663, Los Alamos, New Mexico 87545). *Nuclear Science and Engineering;* **73**: No. 1, 76-83(Jan 1980).

The order of convergence, as the spatial cell widths tend to zero, is derived for six numerical methods that have been proposed for the slab geometry, mulitgroup, discreteordinates neutron transport equations. The authors' results, which in two cases differ from earlier experimental results, are illustrated by means of a simple test problem.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 33308, 33310, 33315, 33792, 33793, 33913, 34354

33151 **(CONF-840833—5) Modeling of concrete response at high temperature.** Pfeiffer, P.; Marchertas, A. (Northwestern Univ., Evanston, IL (USA); Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009587.

From 5. American Society of Civil Engineers/Engineering Mechanics specialty conference; Laramie, WY, USA (1 Aug 1984).

Portions are illegible in microfiche products.

A rate-type creep law is implemented into the computer code TEMP-STRESS for high temperature concrete analysis. The disposition of temperature, pore pressure and moisture for the particular structure in question is provided as input for the thermo-mechanical code. The loss of moisture from concrete also induces material shrinkage which is accounted for in the analytical model. Examples are given to illustrate the numerical results.

33152 **(EDF—82-H-338-449) Nondestructive testing: a bidimensional model for defect detection by eddy current testing.** Rose, C. (Electricite de France, 92 - Clamart). Sep 1982. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751584.

Portions are illegible in microfiche products.

The program presented in this paper calculates the induced e.m.f in the two coils of the probe moving inside the tube of a steam generator. The difference between these two e.m.f shows a defect, a modification of the tube geometry or the presence of the end plate.

33153 **(EPRI-NP—3347-SR, pp 7.1-7.9) Long-term inspection requirements for nuclear power plant components.** Umino, D.T. (Nutech Engineers, Inc., San Jose, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Progress in 1983 includes the completion of studies on the basis for Inservice Inspection intervals for several components. The project was highlighted by efforts on the primary coolant pump casings and pump casing welds. The ASME Section XI rules allow a 10-year deferred interval of the visual examination of the pump casing inside surfaces and the radiographic examination of pump casing welds. This study concluded that further deferral of these examinations is justified on the basis of: (1) a bounding worst case generic fracture mechanics analysis; (2) the radiography and visual inspection completed on four units of the thick-wall, Type F pump casings, which indicate no detected flaw growth or change; and (3) the good operating performance of pump casings to date. Additional work has been completed on the pressurizer and steam generator nozzle-to-vessel welds and nozzle inside radius. The study shows

that justification to change the inspection interval is not supported on a generic basis, since the analysis shows a relatively high potential for flaw initiation and growth. In addition, service history indicated that feedwater nozzle regions have commonly experienced considerable flaw growth due to thermal fatigue. This does not preclude the justification of individual nozzles based on plate unique data.

33154 (EPRI-NP—3347-SR, pp 10.1-10.6) **Demonstration of scanning techniques for IGSCC sizing.** Fleming, M.F.; Rowland, C.B. (Amdata Systems, Inc., San Jose, CA; Dynacon Systems, Inc., Concord, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Three pipe samples are being evaluated by three independant contractors: Amdata Systems, Inc., of San Jose, California; Dynacon Systems, Inc., of Concord, California; and Spectron Development Laboratories of Seattle, Washington. Techniques being utilized include analysis on and off the power-plant site. On-site analysis includes use of data-acquisition and recording equipment, while off-site backup analysis of the recorded waveforms provides more adaptable, comprehensive analysis as required to accomplish the desired confidence in NDE results.

33155 (EPRI-NP—3347-SR, pp 13.1-13.6) **Development of signal processing techniques for automated crack sizing.** Singh, G.P. (Southwest Research Inst., San Antonio, TX). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Objective of this project is to develop signal processing techniques for automated sizing of cracks in the heat-affected zone of austenitic stainless steel pipe weldments. Five signal processing techniques that utilize information from a physically based and field proven satellite-pulse technique are being developed and evaluated for providing more reliable and automated sizing of IGSCC in the heat-affected zone of austenitic stainless steel pipe weldments. The five techniques are temporal and spatial averaging, moving window analysis, spectral analysis, cepstral analysis, and isometric data plots. This project was begun in August 1983 and will be completed in February 1984.

33156 (EPRI-NP—3347-SR, pp 14.1-14.5) **Ultrasonic scattering from intergranular stress corrosion cracks: derivation and application of theory.** Thompson, R.B.; Achenbach, J.D. . (Ames Lab., IA; Northwestern Univ., Evanston, IL). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Intergranular stress corrosion cracking (IGSCC) is a major degradation mechanism in nuclear power plant stainless steel piping. Ultrasonic techniques are presently used to detect and size these cracks. However, performance is limited by the complex nature of the signals reflected from these multiple branched and faceted reflectors. Improved UT equipment and techniques are presently under development by EPRI. In support of that effort, models are reported here which relate the ultrasonic signals from those complex reflectors to their geometrical properties. The models will then be used as a tool in evaluating, refining, and optimizing the advanced techniques.

33157 (EPRI-NP—3347-SR, pp 15.1-15.11) **Development of scanners and booted ultrasonic search units for inspection of nuclear safety class piping.** Fleming, M.F.; Jacobs, B.M. (Amdata Systems, Inc., San Jose, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

The primary objective of the T101-4 project has been the development of automated, remotely controlled scanner mechanisms for the inspection of welds in nuclear safety class piping systems. Another important objective has been the development of booted ultrasonic search units. Together, these scanners and search units can significantly improve the accuracy and repeatability of the ultrasonic data obtained during plant inspections.

33158 (EPRI-NP—3347-SR, pp 16.1-16.6) **Evaluation of nondestructive examinations of intergranular stress corrosion cracking countermeasures.** Beverly, R.L. (Southwest Research Inst., San Antonio, TX). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Countermeasures have been developed for Type 304 stainless steel piping welds to prevent or mitigate the effects of intergranular stress corrosion cracking (IGSCC). However, application of some types of countermeasures may have a detrimental effect on the reliability of ultrasonic testing (UT) techniques required by code and regulatory inservice inspection programs. This program evaluated the effect of backlay cladding (BLC) and induction heating stress improvement (IHSI) countermeasures on the reliability of manual, conventional UT techniques for detection, location, and sizing of IGSCC flaws.

33159 (EPRI-NP—3347-SR, pp 20.1-20.10) **Development of semiautomatic weld crown contouring machine.** Shaw, C.P. (Sigma Research, Inc., Richland, WA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Regulatory and code requirements call for ultrasonic inspection of Class I and II pipe welds in nuclear power-generating plants; however, these techniques require a smooth surface for proper alignment and orientation of the transducer. To produce a suitable finish, weld crowns are contoured by hand-grinding, a laborious process that increases costs and, in operating plants, manrem accumulation. In 1978, EPRI initiated project T 120-1 with the objective of automating the contouring procedure. The prototype was demonstrated successfully under laboratory and field conditions and in vertical and horizontal applications.

33160 (EPRI-NP—3347-SR, pp 23.1-23.18) **Development of a production prototype pressure vessel imaging system.** Neeley, V.I. (Sigma Industrial Systems, Inc., Richland, WA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Integrity of weldments in nuclear reactor Pressure vessels is verified by a pulse-echo ultrasonic (UT) inspection. The Pressure Vessel Imaging System (PVIS) developed by Sigma Industrial Systems, Inc., and its subcontractors (Battelle-Northwest and Southwest Research Institute) represents a transition from the development phase to the prototype production stage. Sigma was responsible for overall project management and developed the holographic signal processor and system interface unit; Battelle-Northwest provided computer hardware and software; and SRI supplied the holographic scanner, controller, and supporting components.

33161 (EPRI-NP—3347-SR, pp 25.1-25.8) **Single Frequency Eddy Current Analysis Program.** Craig, J.N. (General Research Corp., McLean, VA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

The reliable detection and sizing of steam generator cooling tube defects is a major concern of the nuclear power industry.

Present methods are labor intensive and subjective, requiring operator analysis of lissajous patterns displayed on an oscilloscope. The SFPEC program represents an initial attempt at automating the inspection analysis process. An integrated system incorporating data acquisition and analysis functions has been developed. The feasibility of using sophisticated ALN classifiers and defect sizing algorithms has been demonstrated. Overall performance of the algorithms is good, with many possibilities for future improvements. The SFEC system should prove to be a flexible research tool useful in developing and using new techniques for eddy current signal processing and analysis.

33162 (EPRI-NP—3347-SR, pp 26.1-26.9) **Definition of Section XI ultrasonic techniques: the design and manufacture of NDE qualification blocks.** Cole, N.C.; McDearman, W.R. (Combustion Engineering, Inc., Chattanooga, TN). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

A matrix of qualification blocks has been designed to establish the capability to detect near-surface and in-depth flaws. A portion of the near-surface blocks has already been built as screening blocks for feasibility studies. These screening blocks contain crack-like flaws and are weld clad using processes typical of those found in older reactor pressure vessels.

33163 (EPRI-NP—3347-SR, pp 27.1-27.8) **Ultrasonic signal processing for characterization of under-clad flaws in pressure vessels.** Shankar, R. (Tetra Tech., Inc., Arlington, VA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

This project concentrated on developing automatic signal processing methods for flaw depth sizing using ultrasonic digital data collected under specifications developed under a previous program. The methods for sizing flaws were developed from first generating the flaw-echo dynamic curve, which is a plot of the time of flight versus transducer position on the clad surface, and then automatically analyzing the curve to determine flaw depth.

33164 (EPRI-NP—3347-SR, pp 28.1-28.7) **Evaluation and development of improved crack detection techniques.** Pade, E.R. (Westinghouse Electric Corp., Pittsburgh, PA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Recent events in the nuclear power industry have emphasized the need for improved inspection capabilities for reactor pressure vessels. These events include the issuance of Regulatory Guide 1.150, the concern expressed over pressurized thermal shock, and the complexity of the TMI-2 recovery effort. Such events illustrate the need to develop improved techniques for underclad and in-depth crack detection and to provide statistically verifiable and convincing means for demonstrating new technique capability.

33165 (EPRI-NP—3347-SR, pp 29.1-29.9) **Evaluation of the Ultrasonic Data Recording and Processing System (UDRPS).** Moore, M.J. (Dynacon Systems, Inc., Concord, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

An Ultrasonic Data Recording and Processing System (UDRPS) has been built under a contract between Dynacon Systems, Inc. and the Pacific Gas and Electric Company. The UDRPS equipment and technology presents a potentially powerful tool for improved, more reliable, and repeatable ultrasonic inspections of nuclear reactor pressure vessels at higher scan rates than conventional techniques. As the UDRPS techniques had not been evaluated, and performance was not known, the objectives of this project are to: (1) tailor the UDRPS equipment for evaluation at the EPRI NDE Center in Charlotte, North Carolina; (2) prepare an evaluation plan for UDRPS; (3) conduct evaluation tests of UDRPS; (4) provide quantitative and qualitative evaluation results; and (5) recommend improvements to the UDRPS equipment if the UDRPS techniques proved useful.

33166 (EPRI-NP—3347-SR, pp 30.1-30.14) **Detection of stress corrosion cracks in reactor pressure vessel and primary coolant system anchor studs.** Light, G.M.; Jolly, W.D.; Reed, D. (Southwest Research Institute, San Antonio, TX). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Previously, three anchor studs without heater h/lesin tHe reactor pressure vessel (RPV) hold-down system at a nuclear power plant had failed. The failure created uncertainty about the capabilities of conventional NDT to detect cracks in these studs, which measured over 7 feet (213 cm) in length with a 2.5-inch (6.3 cm) diameter. The cause of failure was established as stress corrosion cracking (SCC); the critical crack size was approximately 0.12 inch (0.3 cm), and the initial part of the cracks was confirmed as intergranular in nature. A sharp transition from intergranular to transgranular cleavage had occurred at the fracture line. The major inspection problem was determined to be inspecting longer studs that have no heater hole extending down the center of the stud. The conventional 0-deg inspection had difficulty principally because of attenuation, and the angle-beam technique could not be applied because the stud lacked a heater hole. In response, the CGWT was developed to inspect the studs considered uninspectable using the two mentioned techniques. The two conventional techniques used today in nuclear power plants to inspect studs with heater holes are discussed followed by a discussion of the new CGWT technique.

33167 (EPRI-NP—3347-SR, pp 31.1-31.8) **Bolt inspection by acoustic resonance.** Cole, H.A. Jr. (Randomdec Computers, Los Altos, CA). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Two samples, a standard bar and Southwest Research Bolt No. 3 which had an IGSCC defect, were driven in the longitudinal direction with conventional shaker equipent. The purpose of the test was to find a measurement which would be sensitive to crack defects for possible use in the required inspection process. Several promising measurements were found. The first was lateral vibration of the end of the bolt which underwent a large shift in direction when the wave length of excitation was approximately equal to the distance of the flaw from the end. The second was random vibration at the end of the bolt near the periphery which changed significantly at the approximate angular position of the flaw.

33168 (EPRI-NP—3347-SR, pp 40.1-40.7) **Prototype system for ultrasonic inspection of turbine disc-rims.** Singh, G.P. (Southwest Research Inst., San Antonio, TX). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, Ca 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

Development of a prototype system for the ultrasonic examination of the turbine disc-rim area (RP 1398-13) was initiated by EPRI in May 1983. The ultrasonic examin ation method offers several advantages over the conventionally applied magnetic particle method. These include in situ examination without destructive blade removal at a rapid examination speed, thus resulting in substantial savings in terms of replacement blade cost, blade removal and installation cost, and shroud-band machining cost. A system consisting of a mechanized scanner, an ultrasonic pulser-receiver with 3-gate and peak detector modules, and a 4-channel strip chart recorder has been designed. Mechanical scanner parts are being fabricated. Notches of various dimensions have been machined in a

section of a rotor disc rim to develop the crack sizing approach. Several ultrasonic techniques are in the process of evaluation for crack sizing purposes.

33169 (EPRI-NP—3347-SR, pp 41.1-41.7) **Initial evaluation of annular array technology for use in turbine disc inspection.** Light, G.M.; Mueller, T.A.; Allen, T.L. Jr.; Bloom, E.A. (Southwest Research Inst., San Antonio, TX). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, Ca 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

For the 1983 EPRI program, SwRI has constructed a 25-channel pulser/receiver system based upon concepts evaluated in the prototype system as well as in internally funded research. A 25-element, segmented annular-array transducer with better than 30 dB isolation between elements was also fabricated. The 25-channel system will utilize hybrid pulser preamps to make the total system smaller and easier to apply in the field. The system (transducer and electronics) will be available for testing with the turbine test bed developed under RP 1803-5 by the end of 1983.

33170 (EPRI-NP—3347-SR, pp 49.1-49.19) **EPRI NDE Center.** Nemzek, T.A. (J.A. Jones Applied Research Co., Charlotte, NC). Mar 1984. Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, Ca 94303. Order Number TI84920314. (CONF-8311171—).

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

The EPRI NDE Center was established in 1979 to provide improved and field-qualified nondestructive evaluation equipment, procedures, and personnel training to the utility industry. The activities of the Center are categorized as technology transfer and training and human resource development. Significant progress was achieved during the last year in the areas of steam generator tube inspection, BWR stainless steel pipe inspection, steam turbine inspection, heavy section inspection, signal processing and computer support, and training and human resource development. Major accomplishments were: publication of a document on guidelines for NDE of steam generators, providing assistance and guidance to utilities in responding to regulatory guides 82-03 and 83-02 regarding demonstration of effectiveness of ultrasonic inspection of BWR stainless steel pipe welds; verification of EPRI developed rotor inspection and lifetime prediction technology, demonstration of advanced ultrasonic methods for detecting and sizing defects under the cladding of reactor pressure vessels, and development and teaching of courses in detection and classification of IGSCC in BWR piping.

33171 **(EPRI-NP—3514) ATHOS and FLOW3 simulation of the FRIGG heated rod bundle experiment. Final report.** Heistand, J.W.; Thakkar, J.G. (Combustion Engineering, Inc., Chattanooga, TN (USA). Chattanooga Nuclear Operations). May 1984. 83p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920399.

Void fractions within the Swedish FRIGG experiment were computed with the ATHOS and FLOW3 codes and compared with each other and against measured data. The experimental model consisted of 36 electrically heated rods, each with a heated length of 4.365 m (14.32 ft) and a 13.8 mm (0.54 in.) outer diameter. Heat flux in the simulations ranged from 4.52×10^5 to 8.15×10^5 w/m^2. One transient and four steady state cases were simulated. Resistance factors, inlet geometry, computational grid, and code options were varied in additional base case simulations with ATHOS, while different void fraction correlations were used with the base case model with FLOW3. The ATHOS simulation was three-dimensional, the FLOW3 simulation two-dimensional. Numerous plots comparing the measured and calculated results are provided. In general, agreement between the simulations and the measured results was good, with ATHOS results slightly better. Parametric variation also produced expected qualitative changes. Variations among the results in different cross section zones made trends hard to establish. Experimental data on regional flow rate would have been helpful in interpreting results.

33172 (INIS-BR—120, pp 29-30) **DYNASHELL computer code.** Silva, C.F. da; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33173 (INIS-BR—120, pp 30) **PIPEDYN computer code.** Silva, C.F. da; Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33174 (INIS-BR—120, pp 215) **Implantation in MEF computer code, a finite element method for shell calculations.** Goncalves Filho, O.J.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33175 (INIS-BR—120, pp 215) **Implantation of PLAST computer codes.** Correia Filho, A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33176 (INIS-BR—120, pp 215-216) **Implantation of GMALHA computer code.** Correia Filho, A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33177 **(NUREG/CR—3391-Vol.3) LWR pressure vessel surveillance dosimetry improvement program. Volume 3. 1983 annual report, October 1, 1982-September 30, 1983.** McElroy, W.N.; Kam, F.B.K.; Grundl, J.A.; McGarry, E.D.; Fabry, A. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76FF02170. 200p. (HEDL-TME—83-23). NTIS, PC A09/MF A01; 1 - GPO $6.00; GPO Dep. Order Number DE84013503.

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This report describes progress made in the Light Water Reactor Pressure Vessel Surveillance Dosimetry Improvement Program (LWR-PV-SDIP) during FY 1983. The primary concern of this program is to improve, test, verify, and standardize the physics-dosimetry-metallurgy and the associated reactor and damage analysis procedures and data used for predicting the integrated effects of neutron exposure to LWR pressure vessels and support structures. These procedures and data are being recommended in a new and updated set of ASTM standards being prepared, tested, and verified by program participants. These standards, together with parts of the US Code of Federal Regulations and ASME codes, are needed and used for the assessment and control of the condition of LWR pressure vessels and support structures during the 30- to 60-year lifetime of a nuclear power plant.

33178 **(NUREG/CR—3391-Vol.4) LWR pressure vessel surveillance dosimetry improvement program. Quarterly progress report, October 1983-December 1983.** Lippincott, E.P.; McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1984. Contract AC06-76FF02170. 91p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84014091.

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In order to achieve reliable surveillance dosimetry for pressure vessels in light water reactors, it is necessary to perform sensor calibration, other dosimetry reference measurements, and validation of transport calculation in benchmark and test region neutron fields. One element in this effort is the development of a compendium of experimental and calculated dosimetry-related information for these fields. The first two entries in this compendium, the ^{252}Cf and ^{235}U fission spectrum standard fields, were completed in 1978. The revi-

sion given in this Progress Report provides updated facility information and evaluated dosimetry cross sections with a cut-off date of June 1983.

33179 **(NUREG/CR—3630) Equipment qualification methodology research: tests of pressure switches.** Salazar, E.A. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 181p. (SAND—83-2652). NTIS, PC A09/MF A01; 1 - GPO; GPO Dep. Order Number DE84012931.

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Pressure switches, two each of five different models from two manufacturers, were tested in baseline evaluation tests typical of IEEE-323 (1974) suggested profiles as part of the NRC-sponsored Equipment Qualification Methodology Research Test Program (A-1355). The tests incorporated generic seismic and loss-of-coolant accident (LOCA) environments to assess the functional capabilities of unaged equipment. During the baseline evaluation tests, the seismic environment did not affect the functionality of the pressure switches, but the LOCA physical damage in four of five models tested. As a result, eight other switches of the same make and model as those used in the baseline evaluation tests were tested in a follow-up test. In the follow-up test (a discrete-step pressure ramp LOCA environment) erratic functional behavior or complete failure was observed in all the equipment early in the test.

33180 **(NUREG/CR—3671) Assessment of radiation effects relating to reactor pressure vessel cladding.** Corwin, W.R. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 62p. (ORNL—6047). NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. Order Number DE84013925.

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Because the weld overlay cladding on the interior of light-water reactor pressure vessels was applied for corrosion resistance and not for structure, little attention has been given to the potential of mechanical property degradation due to radiation exposure. In light of the concerns recently raised regarding overcooling transients in nuclear power reactors, it has been suggested that any such degradation could adversely affect the serviceability and/or integrity of the vessel. A literature survey assesses the current knowledge regarding the effects of neutron radiation on the mechanical and fracture properties of stainless steel weld overlay cladding under conditions relevant to light-water reactor operation. In particular, effects on the material's microstructure and tensile, fatigue, impact, and fracture properties are examined. Although information is lacking on the specific materials under the exact irradiation conditions of interest, a wealth of information is available on irradiated stainless steel weldments in general, from which basic behavioral trends can be obtained. Some irradiation embrittlement apparently does occur in stainless steel weldments at the relatively low temperatures and fluences typical of light-water reactors. Tensile strength increases and ductility decreases. Low-cycle fatigue behavior is degraded somewhat, but high-cycle fatigue and fatigue crack growth seem largely unaffected. Effects of δ-ferrite on fracture resistance are small in both irradiated and unirradiated materials. Notch impact and fracture toughness are both reduced by irradiation, and a dependence of toughness on testing rate, not seen in wrought material, is indicated.

33181 **Radiation annealing mechanisms of low-alloy reactor pressure vessel steels dependent on irradiation temperature and neutron fluence.** Pachur, D. (Kernforschungsanlage Julich Postfach 1913, 5170 Julich). *Nuclear Technology;* **59**: No. 3, 463-475(Dec 1982).

Heat treatment after irradiation of reactor pressure vessel steels showed annealing of irradiation embrittlement. Depending on the irradiation temperature, the embrittlement started to anneal at about 220°C and was completely annealed at 500°C with 4 h of annealing time. The annealing behavior was normally measured in terms of the Vickers hardness increase produced by irradiation relative to the initial hardness as a function of the annealing temperature. Annealing results of other mechanical properties correspond to hardness results. During annealing, various recovery mechanisms occur in different temperature ranges. These are characterized by activation energies from 1.5 to 2.1 eV. The individual mechanisms were determined by the different time dependencies at various temperatures. The relative contributions of the mechanisms showed a neutron fluence dependence, with the lower activation energy mechanisms being predominant at low fluence and vice versa. In the temperature range where partial annealing of a mechanism took place during irradiation, an increase in activation energy was observed. Trend curves for the increase in transition temperature with irradiation, for the relative increase of Vickers hardness and yield strength, and for the relative decrease of Charpy-V upper shelf energy are interpreted by the behavior of different mechanisms.

33182 **Analytic predictions of the annealing response of A533-B reactor vessel steel welds.** Main, A.P.; Shriver, B.L. (University of Virginia Department of Nuclear Engineering and Engineering Physics Charlottesville, Virginia 22901). *Nuclear Technology;* **59**: No. 3, 456-462(Dec 1982).

A model for predicting the annealing response of A553-B weld materials has been developed. This model assumes that the irradiation-induced shifts in the nil ductility transition temperature (ΔNDTT) and Charpy upper shelf energy (ΔUSE) are a result of the introduction of three types of defects into the alloy. The recovery of ΔNDTT and ΔUSE depends on the concentration of each defect remaining after the annealing treatment. The three defect types, including their diffusion constants, are assumed to be the same for all A533-B welds. However, the contribution of each defect type to ΔNDTT and ΔUSE depends on the chemical composition of the material and possibly the neutron fluence. Copper, nickel, manganese, and chromium were found to correlate with ΔNDTT, while sulfur and phosphorus appeared to correlate with ΔUSE. Once the relative contribution of each defect type is known, the recovery of ΔNDTT and ΔUSE is predicted based on diffusion calculations. Both the annealing temperature and time are accounted for in the calculations. The final model was compared with experimental data on three materials tested by Westinghouse Electric Corporation and two materials tested by the Naval Research Laboratory. The model accurately predicted the recovery of ΔNDTT for all five materials annealed at 343°C (650°F) to 454°C (850°F) for 24 to 336 h. The predicted recovery of ΔUSE was not as accurate as that of ΔNDTT.

33183 **Significance of selected residual elements to the radiation sensitivity of A302-B steels.** Hawthorne, J.R. (Naval Research Laboratory Thermostructural Materials Branch, Material Science and Technology Division Washington, DC 20375). *Nuclear Technology;* **59**: No. 3, 440-455(Dec 1982).

The effects of three levels of copper content and phosphorus content and two levels of sulfur content on radiation sensitivity and postirradiation heat treatment response were explored for a reactor pressure vessel steel, Type A302-B. Test plates for the investigation were produced from 182-kg (400-lb) laboratory melts. The contributions of individual elements were assessed from Charpy-V (CV) notch ductility changes with 288°C (550°F) irradiation and with a 343°C (650°F), 168-h postirradiation heat treatment. Limited studies of properties recovery by postirradiation 399°C (750°F) heat treatment were also made. Radiation embrittlement sensitivity, as shown by CV transition temperature elevation and CV upper shelf reduction, generally increased with increased copper and phosphorus content and with decreased sulfur content. Certain ranges of phosphorus and copper content were found to be more critical than others. Response to 343°C (650°F) postirradiation heat treatment, as evidenced by transition temperature recovery in degrees Celsius, appeared to be independent of copper, phosphorus, and sulfur content for the ranges investigated. Response to heat treatment also appeared to be independent of the magnitude of the prior transition temperature elevation by irradiation. On the other hand, a dependence of percentage recovery on impurity element content was observed. A dependence of upper shelf recovery on copper content was also found. Six of the eight plate compositions exhibited full upper shelf recovery but only small transition temperature recovery after 343°C (650°F) heat treatment.

33184 **Investigation of cable deterioration inside reactor containment.** Clough, R.L.; Gillen, K.T. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Nuclear Technology;* **59**: No. 2, 344-354(Nov 1982).

The deterioration of polyethylene and polyvinyl chloride cable materials in the containment building of an operating nuclear reactor has been investigated. Since the maximum dose experienced by the cable materials was only 2.5 Mrad during about 12 yr of operating life, the extent of material degradation was surprising. Laboratory aging experiments on the two materials established that the cause of the material deterioration in the plant was radiation-induced oxidation. The degradation rate was correlated with local levels of radiation intensity. It was determined that strong synergisms of radiation and elevated temperature, and also dose-rate effects, lead to the surprisingly rapid degradation rates found with these materials. It is concluded that in the design of laboratory methods for aging and qualification testing of organic materials for use in a nuclear plant environment, the possible occurrence of dose-rate effects and synergisms needs to be taken into account.

33185 **Application of an ion exchange method for sensitivity improvement of an automated radionuclide analysis system.** Tokoi, H.; Fujii, M.; Ishizuka, A.; Kitaguchi, H.; Kudou, T.; Mizuno, K.; Ogushi, A. (Energy Research Laboratory, Hitachi, Ltd. 1168 Moriyama-cho, Hitachi, Ibaraki). *Nuclear Technology;* **57**: No. 2, 285-291(May 1982).

A high sensitivity radionuclide analysis system has been developed. An automated system employs an ion exchange method to concentrate target nuclides in reactor coolant water. The system consists of sample treatment equipment and an automatic sample changer in conjunction with a multichannel gamma-ray spectrum analyzer. The sample treatment equipment performs sampling, filtration, sample volume selection, and ion exchange. These four processes are fully automated. Performance tests show that the lowest analysis level is 10^{-6} μCi/ml of ^{131}I within 10% reproducibility. The processing time from sampling to ion exchange is within 10 min for samples <100 ml.

33186 **Bend testing for miniature disks.** Huang, F.H.; Hamilton, M.L.; Wire, G.L. (Hanford Engineering Development Laboratory, P.O. Box 1970, Richland, Washington 99352). *Nuclear Technology;* **57**: No. 2, 234-242(May 1982).

A bend test was developed to obtain ductility measurements on a large number of alloy variants being irradiated in the form of miniature disks. Experimental results were shown to be in agreement with a theoretical analysis of the bend configuration. Disk specimens fabricated from the unstrained grip ends of previously tested tensile specimens were used for calibration purposes; bend ductilities and tensile ductilities were in good agreement. The criterion for estimating ductility was judged acceptable for screening purposes.

33187 **Radiation-induced outgassing from sorption pump material.** Patel, V.N.; Anno, J.N. (University of Cincinnati Department of Chemical and Nuclear Engineering, Cincinnati, Ohio 45221). *Nuclear Technology;* **56**: No. 2, vp(Feb 1982).

The radiation-induced outgassing (RIO) was measured for a molecular sieve material used in sorption pumps (Linde Molecular Sieve Type 13X) exposed at 20°C to ^{60}Co gamma radiation at a dose rate of 9.0 X 10^4 rad/h. The measured outgassing rate was found to be (7.03 + or 2.21) X 10^{-10} Pa X l/(cm^3 X s) X Mrad^{-1} X h^{-1}, which is consistent with values determined previously for various metals. This RIO is equivalent to a thermal bakeout at only 30°C. It was concluded for this material that the RIO is not a viable alternative to thermal bakeouts.

33188 **Downflow post-critical heat flux heat transfer to low pressure water.** Robershotte, P.; Griffith, P. (Massachusetts Institute of Technology Department of Mechanical Engineering, 77 Mass Avenue Cambridge, Massachusetts 02139). *Nuclear Technology;* **56**: No. 1, 134-140(Jan 1982).

Post-critical heat flux heat transfer data for water in downflow have been obtained for the following conditions: mass velocity, 48.8 to 147 kg/sXm^2; wall temperature, 538 to 760°C; pressure, 1.3 to 2.6 bars; quality, 4.1 to +5.8%; tube diameter, 1.25 cm; and tube length, 66 cm. At low mass velocity, a frozen equilibrium model predicts the data well. At high mass velocity, droplet-vapor heat transfer is good enough so that a homogeneous equilibrium model predicts the data. Under no circumstances is droplet-wall heat transfer significant. When the vapor is in laminar flow, the heat transfer is particularly poor and the radiant heat transfer becomes a significant fraction of the total.

33189 **Weighing of heavy vessels using strain gauges.** Ruiter, J.R. (N.V. tot Keuring van Elektrotechnische Materialen Arnhem). *Nuclear Technology;* **55**: No. 3, 683-689(Dec 1981).

The effect of pressure and temperature fluctuations is greatly reduced by appropriate design and by prestressing of the lines in an apparatus for remote, continuous weighing of heavy pressurized vessels (60 bar) at high temperatures (250°C), even when these vessels are connected to other systems by means of metal lines. The weighing device is based on the application of strain gauges. The accuracy of measurement is within 0.5%. Weighing devices of this type can be applied, for example, in the process industry.

33190 **Thermal response of a flat plate of finite thickness immersed in a fluid with oscillating temperature.** Poindexter, A.M. (Westinghouse Electric Corporation Advanced Reactors Division, P.O. Box 158 Madison, Pennsylvania 15663). *Nuclear Technology;* **55**: No. 3, 656-661(Dec 1981).

Thermal response of flat plates immersed in a fluid with oscillating temperature is of current interest in the nuclear industry. A dimensionless solution characterizing the internal temperature response shape of the plate in terms of a single dimensionless parameter has been obtained. The solution is plotted in terms of dimensionless parameters. The maximum value of surface-to-average temperature difference in the plate and the elastic stress occurring during the sinusoidal temperature cycle can be determined using this solution without plotting and averaging temperature distributions for several different times during the cycle.

33191 **Initial-value methods for a simplified subchannel model of thermal-hydraulic behavior.** Nelson, P.; Neil, C.H. (Texas Tech University Institute for Numerical Transport Theory Department of Mathematics, Lubbock, Texas 79409). *Nuclear Science and Engineering;* **76**: No. 3, 366-370(Dec 1980).

It is shown that many of the numerical difficulties and phenomena encountered in subchannel analysis have counterparts within a simple two-subchannel model, which permits analytic study of these matters. Results are presented that suggest that the reported inability of initial-value techniques for subchannel models to cope with flow-blockage problems may be peculiar to the particular initial-value techniques frequently used.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 33914

33192 (INIS-BR—120, pp 210-211) **Determination of the thermal conductivity coefficient for uranium oxide pellets.** Nagy, G.P.; Brito Aghina, L.O. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33193 (INIS-BR—120, pp 211-212) **Experimental determination of local heat transfer coefficient in a fuel assembly with the tight pins.** Moeller, S.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33194 **Turbulent flow in rod bundles with geometrical disturbances.** Hejna, J.; Mantlik, F. (Nuclear Research Institute 250 68 Rez). *Nuclear Technology;* **59**: No. 3, 509-525(Dec 1982).

The results of measurements of shear stress distribution around wetted surfaces and velocity fields of turbulent flow in rod bundles with geometrical disturbances are presented. Experiments

were performed on an aerodynamic model composed of 19 rods in a hexagonal arrangement 6 m long with an outside diameter of 120 mm and a pitch-todiameter ratio of 1.17. The geometric disturbances were modeled by the displacement of the central rod from its regular position. An important influence of secondary flows on the velocity fields was revealed. From the experimental data, empirical formulas for shear stress distribution were derived.

33195 **Cesium release from coated fuel particles with failed coatings.** Amian, W.; Stover, D. (Kernforschungsanlage Julich GmbH, Institut fur Reaktorentwicklung Postfach 1913, 5170 Julich). *Nuclear Technology;* **57**: No. 2, 279-290(Nov 1982).

A laser boring technique has been used to simulate failed coatings of fuel particles. The cesium fractional release from irradiated failed particles is measured in time intervals during an annealing treatment at 1000 and 1200°C, respectively. In addition, the distribution of cesium along kernel and coating is measured by destructive gamma spectrometry. The fractional release versus time data are quantitatively recalculated by superposing diffusion from kernel and buffer layer using a two-zone assembly in spherical geometry. The derived kernel diffusion constants agree reasonably well with corresponding data from in-pile measurements.

33196 **An extension of the nodal Green's function method for reactor analysis.** Yu-Man, C.; Chambre, P.L.; Grossman, L.M.; Lew, B.S. (University of California, Department of Nuclear Engineering Berkeley, California 94720). *Nuclear Science and Engineering;* **81**: No. 2, 272-280(Jun 1982).

A method is presented for calculating the nodal flux distribution and the pin power distribution, as well as the effective multiplication, in a nuclear power reactor described by the one-dimensional, two-group diffusion equation. The method is based on the use of Green's functions in a nodal reactor description, and it extends the work of previous authors by including burnup-induced heterogeneities and by calculating local pin power distributions from spatial flux distributions within the node obtained by piecewise polynomial interpolation. An advantage of the method is that one obtains power and exposure distributions at fine mesh points, while retaining the economy characteristic of solutions of the neutron diffusion equation in the nodal framework. In numerical calculations carried out on model problems, good agreement is achieved between the results of the extended nodal Green's function method and those obtained using the CITATION finite difference code.

33197 **An equivalence relation for a doubly heterogeneous lattice.** Segev, M. (Ben-Gurion University of the Negev, Department of Nuclear Engineering, P.O. Box 653, Beer-Sheva 84 120). *Nuclear Science and Engineering;* **81**: No. 2, 151-160(Jun 1982).

This paper considers a lattice consisting of an infinite uniform distribution of clusters in an external moderator and a cluster consisting of a uniform distribution of absorber lumps in an internal moderator. The lattice is characterized by these parameters: cluster mean chord length; probability of neutrons leaving a cluster to collide in the external moderator prior to crossing a cluster; adjustable Bell factor for the clusters; lump mean chord length; probability of neutrons leaving a lump to collide in the internal moderator prior to crossing a lump; adjustable Bell factor for the lumps; internal moderator volume fraction in the cluster; internal moderator macroscopic cross section. The flux in (or resonance integral of) the absorber lump is equivalent to the flux in an infinite medium consisting of the lump material homogeneously mixed with a moderator of a calculated cross section which is dependent on a factor termed the "double heterogeneity" factor abbreviated "doublet". In the limit of an infinite single cluster, this factor approaches 1, yielding the correct single heterogeneity expression for the moderator cross section. This expression is quite general; the only restriction it places on the lattice structure is that a cluster contain many lumps.

33198 **A modified Wigner rational approximation for neutron collision escape probability from bare homogeneous reactor assemblies.** Kumar, A. (Bhabha Atomic Research Centre, Neutron Physics Division Trombay, Bombay 400 085). *Nuclear Science and Engineering;* **81**: No. 1, 66-74(May 1982).

The neutron collision escape probability from a medium depends on the shape of spatial distribution of the source. The case of a uniform or flat source distribution has been investigated extensively from time to time. In the present work, the case of bare homogeneous reactor assemblies having a centrally peaked neutron source distribution has been analyzed for predicting collision escape probability as a function of assembly size measured in terms of the optical mean chord length. An approximation, known as the modified Wigner rational approximation, is derived and given. Parameters have been determined for infinite slab, infinite cylinder, sphere, cube, and finite cylinders of height-to-diameter ratio varying from 0.1 to 20. It is shown that it is possible to predict the collision escape probability within approximately + or - 2% of the exact value for the optical mean chord length ranging from 0 to 20 mean-free-paths (mfp). Generally, for a given lΣ /SUB t/ , the collision escape probability value for the centrally peaked source is lower than that for the uniform source. But it is found that for very thin infinite slab assemblies of optical mean chord length $\leqq$ 1.5 mfp, the collision escape probability for centrally peaked source distribution is higher than that for uniform source distribution. The reason for this anomaly is discussed.

33199 **A model for gap conductance in nuclear fuel rods.** Loyalka, S.K. (University of Missouri-Columbia Nuclear Engineering Program, Columbia, Missouri 65211). *Nuclear Technology;* **57**: No. 2, 220-227(May 1982).

Computation of nuclear reactor fuel behavior under normal and off-normal conditions is influenced by gap conductance models. These models should provide accurate results for heat transfer for arbitrary gap widths and gas mixtures and should be based on considerations of the kinetic theory of gases. There has been considerable progress in the study of heat transfer in a simple gas for arbitrary Knudsen numbers (Kn = l/similar to d, where l is a mean-free-path and similar d is the gap width) in recent years. Using these recent results, a simple expression for heat transfer in a gas mixture (enclosed between parallel plates) for an arbitrary Knudsen number has been constructed, and a new model for gap conductance has been proposed. The latter reproduces the free molecular (small gap, Kn >> 1) and the jump limits (large gaps, Kn << 1) correctly, and it provides fairly accurate results for arbitrary gap widths. The new model is suitable for use in large fuel behavior computer programs.

33200 **Determination of thermal accommodation coefficients of helium, argon, and xenon on a surface of zircaloy-2 at about 25°C.** Thomas, L.B.; Loyalka, S.K. (University of Missouri-Columbia Department of Chemistry, Columbia, Missouri 65211). *Nuclear Technology;* **57**: No. 2, 213-219(May 1982).

Estimation of gap conductance in nuclear reactor fuel rods requires values for thermal accommodation coefficients of several gases on Zircaloy, uraniumdioxide, stainless steel, and other surfaces. These values for Zircaloy-2 have now been obtained by observing cooling rates of a Zircaloy sphere suspended in the several gases. These measurements are on so-called engineering surfaces, and no special attempt other than baking under high vacuum pumping was used to clean the surfaces. It is found, however, that if the recent kinetic theory results of Cercignani and Pagani on heat transfer from a sphere are used, then quite constant values for accommodation coefficients on a range of pressures are obtained.

33201 **The possible impact of fuel pellet cracking on inferred gap conductance and fuel stored energy.** Lanning, D.D. (Pacific Northwest Laboratory P.O. Box 999, Richland, Washington 99352). *Nuclear Technology;* **56**: No. 3, 565-574(Mar 1982).

Thermally induced cracking of the UO_2 fuel pellets undoubtedly results in some reduction of the effective fuel thermal conductivity, relative to that for solid UO_2 This effect may be approximated by appropriately chosen "crack factors" that reduce the solid-UO_2 thermal conductivity. The authors demonstrate that the assumption of reduced fuel conductivity always results in a reduction of the fuel stored energy that is inferred from fuel centerline temperature data. This reduction occurs whether the crack factors are introduced as simple constants or as functions of radial position

within the fuel pellet. If fuel performance computer codes remain "tuned" to the current body of centerline temperature data, those codes will predict lower fuel stored energy when fuel cracking is taken into account regardless of the modeling assumptions invoked. Accounting for fuel cracking should lead to a reduction in calculated peak cladding temperatures obtained in some loss-of-coolant accident simulations.

33202 **A model for the effective thermal and mechanical properties of cracked UO_2 pellets.** Williford, R.E.; Lanning, D.D.; Mohr, C.L. (Pacific Northwest Laboratory, Battelle Boulevard Richland, Washington 99352). *Nuclear Technology;* **56**: No. 2, 340-350(Feb 1982).

An alternate thermal-mechanical behavior model for cracked UO_2 pelletized fuel is presented. It is recognized that fuel cracking and relocation cause some of the initial pellet-cladding gap (the "free area") to be moved into the fuel in the form of cracks. The introduction of this free area into the fuel causes the fuel effective thermal conductivity and effective elastic moduli to be simultaneously reduced to values significantly less than laboratory data for solid pellets. Hooke's Law and a crack compliance model are used to deduce the effective fuel conductivity and moduli from simultaneous in-reactor measurements of rod power, fuel center temperature, and cladding elongation. The fuel-cladding "gap" is considered as another "crack," and is also described by the crack compliance model, which predicts that there is always some finite amount of fuelcladding contact. The primary thermal mechanical feedback mechanism is found to be due to crack closure effects on fuel effective thermal conductivity, rather than gap closure effects on gap conductance.

33203 **Irradiation performance of coated fuel particles with fission product retaining kernel additives.** Forthmann, R. (Kernforschungsanlage Julich GmbH Postfach 1913, 5170 Julich). *Nuclear Technology;* **56**: No. 1, 81-92(Jan 1982).

Four irradiation experiments for testing the efficiency of fission-product-retaining kernel additives in coated fuel particles are described. The evaluation of the obtained experimental data led to the following results: Alumina-silica kernel additives reduce the inpile release of ^{90}Sr and ^{140}Ba from BISO-coated particles at temperatures of about 1200°C by two orders of magnitude, and the cesium release from kernels by about one order of magnitude. Effective transport coefficient including all parameters that contribute to kernel release for $(Th,U)O_2$ mixed oxide kernels and low-enriched UO_2 kernels containing 5 wt% alumina-silica additives are given by the equations: log D /SUB k/ $/m^2.s^{-1} = -36028/T + 2.261$ (^{90}Sr) and log D /SUB k/ $/m^2.s^{-1} = -29646/T + 1.826$ (/SUP 134/ 137/ Cs). Alumina-silica kernel additives are ineffective for retaining /SUP 110m/ Ag in coated particles. However, an intact silicon carbide interlayer was also found to be ineffective at temperatures > 1200°C. The penetration of fission-product-containing eutectic additive melts into the buffer layer during irradiation can be avoided by using additives that consist of alumina and mullite without an excess of silica. Annealing of LASER-failed irradiated particles and results of the irradiation test FRJ2-P20 indicate that the efficiency of alumina-silica kernel additives is not altered if the coating becomes defective.

33204 **The effect of residual decontamination reagent on stress corrosion cracking of austenitic materials under high temperature water.** Yajima, M.; Sasaki, S.; Takashima, N.; Takimoto, S. (Toshiba Corporation Nuclear Energy Group, 13-12, Mita 3-chome, Minato-ku, Tokyo 108). *Nuclear Technology;* **56**: No. 1, 120-127(Jan 1982).

Stress corrosion cracking (SCC) of austenitic materials has been investigated under high temperature water into which a trace level of chemical reagent for reactor process decontamination was injected to simulate residual chemical reagent in normal reactor cooling water. Creviced bend beam and 4-in. pipe tests have been performed with two kinds of concentrated-type reagents and two kinds of dilute-type reagents. It was found that concentrated-type reagents, when injected into high temperature water by 1/1000 of a specified concentration, work as an oxygen scavenger and significantly inhibit intergranular stress corrosion cracking in both sensitized Type 304 stainless steel and Inconel alloys 600 and X-750. Dilute-type reagents did not reduce dissolved oxygen (DO) at all and one of the reagents tested accelerated SCC in Type 304 stainless steel when injected into high temperature water by 1/1000 of a specified concentration. Another dilute-type reagent partially suppressed cracking of Type 304 stainless steel at the same residual reagent concentration. It is suggested that residual level decontamination reagent will work in two ways, depending on residual concentration. When residual concentration is rather high, it will work as an oxygen scavenger and will not have detrimental effects in terms of SCC; when reagent concentration is very diluted, it will accelerate cracking in heavily sensitized Type 304 stainless steel, regardless of the type or kind of decontamination reagent. This effect will be reduced in actual operation since the DO level is about0.2 ppm maximum in the normal reactor water.

33205 **In-reactor measurement of cladding strain: fuel density and relocation effects.** Fehrenbach, P.J.; Morel, P.A.; Sage, R.D. (Atomic Energy of Canada Limited Research Company Chalk River Nuclear Laboratories, Fuel Materials Branch Chalk River, Ontario KOJ 1JO). *Nuclear Technology;* **56**: No. 1, 112-119(Jan 1982).

Measurement of fuel element diameters while the fuel is operating at power, in-reactor, has provided evidence of in-reactor fuel densification and relocation. The design and operation of the in-reactor diameter measuring rig used for these measurements are described. Diameter measurements were obtained from two fresh Zircaloy-clad UO_2 elements containing fuel of 10.64 and 10.82 Mg/m^3 density, respectively, at linear power outputs up to 61 kW/m. Similar measurements were also obtained from a 10.64 Mg/m^3 density element after low power irradiation at 26 kW/m to a burnup of 75 MW X h/kg uranium. Results indicate that higher starting fuel density and prior irradiation both reduce the amount and rate of in-reactor fuel densification observed. Diameter measurements following reactor shutdowns, particularly on the higher burnup element, also indicate that fuel relocation can overcome diameter decreases due to fuel densification and restore pellet-clad interaction.

33206 **Joining techniques for core flow test loop fuel rod simulators.** Moorhead, A.J.; McCulloch, R.W. (Oak Ridge National Laboratory Metals and Ceramics Division, Oak Ridge, Tennessee 37830). *Nuclear Technology;* **56**: No. 1, 7-22(Jan 1982).

Laser welding and furnace brazing techniques have been developed to join subassemblies for fuel rod simulators (FRSs) that have survived up to 1000-h steady-state operation at 700 to 1100°C cladding temperatures and over 5000 thermal transients, ranging from 10 to 50°C/s. A pulsed-laser welding procedure uses small diameter filler wire to join one end of a resistance heating element to a tubular conductor. The other end of the heating element is laser welded to an end plug, which in turn is welded to a central conductor. Before these welding operations, the intermediate material conductors (either tubular or rod) are vacuum brazed to matching copper leads. On room temperature tensile testing, 10 of 11 brazements between copper and nickel rods failed in the copper rather than the brazement. The thin walls and ductility of the copper and nickel tubular conductors caused joint machining and fitup problems. Accordingly, it has not been possible to consistently produce tensile test samples of brazed dissimilar metal tubular conductors that will fail outside the joint area. A unique tubular electrode carrier has also been developed for gas tungsten arc welding FRSs to the tubesheet of a test assembly. Two seven-rod mockups of the simulator-to-tubesheet joint area were welded and successfully cycled 500 times from 370°C (698°F) down to 100°C (212°F) with an internal pressure of 11.72 MPa (1700 psi). No leakage was detected by helium mass spectrometry, either before or after testing. Modified versions of the electrode carrier were developed for brazing electrical leads to the upper ends of the FRSs. Satisfactory brazes have been made on both single-rod mockups and arrays of simulators.

33207 **Influence of surface condition on crack initiation in iodine-induced stress corrosion cracking of zircaloys.** Cubicciotti, D.; Jones, R.L.; Syrett, B.C. (SRI International, Menlo Park, California 94025). *Nuclear Technology;* **55**: No. 3, 720-713(Dec 1981).

The effect of surface condition on the initiation of iodine-induced stress corrosion cracks in Zircaloy tubing was investigated. The internal surface of the Zircaloy tubing was given one of three surface treatments, namely etching, grit blasting, or shot blasting. Each of these treatments can readily be performed commercially on Zircaloy fuel cladding. Specimens of surface-treated tubing were locally stressed in an iodine environment at 590 K by indenting the outer surface of the tube wall with a small steel ball. The crack initiation pattern on the inner surface was examined in a scanning electron microscope. Crack initiation was found to be least developed for etched surfaces, was most developed for shot-blasted surfaces, and was developed to an intermediate degree for grit-blasted surfaces. Apparent anomalies between these crack initiation data and the time to failure data obtained previously in tube pressurization tests are rationalized on the basis of the cracking processes.

33208 **The effects of texture and surface condition on the iodine stress corrosion cracking susceptibility of unirradiated Zircaloy-2.** Syrett, B.C.; Cubicciotti, D.; Jones, R.L. (SRI International, Menlo Park, California 94025). *Nuclear Technology;* **55**: No. 3, 628-641(Dec 1981).

Four lots of stress-relieved Zircaloy-2 tubing were prepared from a single heat of the alloy. Tube reduction parameters were controlled so that each lot had a different crystallographic texture. The tubing with the most radial (least tangential) basal pole intensity was shown to have a Kearns texture number in the radial direction of 0.61, whereas the equivalent value for the tubing with the least radial texture was 0.48. Each lot of tubing was given one of three surface treatments: etched, etched and grit blasted, or lightly etched and shot blasted. The iodine stress corrosion cracking (SCC) susceptibility of the unirradiated tubing was determined by measuring the time to failure in a standard tube pressurization test at about 593 K in which 6 mg of iodine was present for each square centimetre of exposed Zircaloy surface. The results showed that texture has a large effect on SCC susceptibility and that surface condition has a significant but lesser effect. The SCC resistance was lowest in the material with the most tangential basal pole intensity and increased as the texture became more radial. The lightly etched and shot-blasted surface resulted in times to failure that were shorter than the times for the other two surface conditions. However, it seems likely that the influence of surface treatment is quite complex and that SCC susceptibility can change significantly with a seemingly minor change in the surface treatment technique. The effect of texture was interpreted in terms of its influence on strength, on deformation characteristics, and on orientation of SCC susceptible planes with respect to the dominant tensile (hoop) stress. The effect of surface condition was interpreted in terms of its influence on residual stresses, on local texture changes, on local stress concentration, and on chemical activity.

33209 **Design, production, and evaluation of a zircaloy-clad uranium target for an intense pulsed neutron source application.** Loomis, B.A.; Fogle, G.L.; Gerber, S.B.; Thresh, H.R. (Argonne National Laboratory Materials Science Division, 9700 S. Cass Avenue, Argonne, Illinois 60439). *Nuclear Technology;* **55**: No. 3, 617-627(Dec 1981).

The design of a Zircaloy-2-clad uranium alloy (450 ppm carbon, 250 ppm iron, 350 ppm silicon) target that can function as a pulsed spallation neutron source on interaction of a pulsed 500-MeV proton beam with the uranium nuclei is determined by consideration of irradiation damage, energy deposition, and thermal cycling effects in the target. The designed target is comprised of eight watercooled Zircaloy-2-clad uranium alloy disks, 10 cm in diameter and 2.7 cm thick operating at a maximum uranium alloy centerline temperature of 330°C. The production of the Zircaloy-2-clad uranium alloy disks involves remelting of the cast uranium alloy by the consumable electrode technique and bonding of the Zircaloy-2 to the uranium alloy by subjecting the composite to an isostatic-helium pressure at 840°C. The lifetime of the disks in the target before cracking of the Zircaloy-2 cladding owing to lowfrequency thermal cycling fatigue is estimated from stress calculations to be about 500 days. The results of thermal cycling tests on a disk tend to confirm the results of the stress calculations.

2204 Control Systems

REFER ALSO TO CITATION(S) 33316

33210 **(BMI—1983-012) Comparative study of instrumentation and control engineering systems in nuclear power plants and in the Federal German railway system.** Frey, W.; Gueldner, W.; Gloe, K.H.; Marcus, G. (Bundesministerium des Innern, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Sep 1983. 84p. (In German). (GRS-A—840). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751499.

This report compares the control and instrumentation equipment of safety systems of the DB (German Railways) to those of nuclear power plants. Starting from the basic safety philosophies, the comparison covers system maintenance, the possibility of manual intervention, and also hardware safety measures for relay technology and for the use of computer systems. The comparative evaluation of common features and differences concerning both hardware and administrative measures tried to find out to what extent DB experience can be used for the special problems of nuclear power plants. An extensive documentation of DB control and instrumentation technology can be found in a supplement volume.

33211 **(INIS-BR—120, pp 32) Reactivity calculation in tests of control rod drop.** Nobrega, J. de A.W. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33212 **(NUREG/CR—3606) Nuclear power plant control room crew task analysis database: SEEK system. Users manual.** Burgy, D.; Schroeder, L. (General Physics Corp., Columbia, MD (USA)). May 1984. 131p. (GP-R—212106). NTIS, PC A07/MF A01 - GPO* $5.50. Order Number DE84901384.

Portions are illegible in microfiche products.

The Crew Task Analysis SEEK Users Manual was prepared for the Office of Nuclear Regulatory Research of the US Nuclear Regulatory Commission. It is designed for use with the existing computerized Control Room Crew Task Analysis Database. The SEEK system consists of a PRIME computer with its associated peripherals and software augmented by General Physics Corporation SEEK database management software. The SEEK software programs provide the Crew Task Database user with rapid access to any number of records desired. The software uses English-like sentences to allow the user to construct logical sorts and outputs of the task data. Given the multiple-associative nature of the database, users can directly access the data at the plant, operating sequence, task or element level - or any combination of these levels. A complete description of the crew task data contained in the database is presented in NUREG/CR-3371, Task Analysis of Nuclear Power Plant Control Room Crews (Volumes 1 and 2).

33213 **Development of hafnium and comparison with other pressurized water reactor control rod materials.** Keller, H.W.; Hollein, D.A.; Hott, A.C.; Shallenberger, J.M. (Westinghouse Electric Corporation, Water Reactor Divisions P.O. Box 3912, Pittsburgh, Pennsylvania 15230). *Nuclear Technology;* **59**: No. 3, 476-482(Dec 1982).

Development of a special application of hafnium for pressurized water reactor control rods is discussed. A unique feature of the design is the sealing of the hafnium material inside protective stainless steel tubing, whereas in prior applications the hafnium material was exposed directly to the reactor primary coolant. A comparison is made of the new hafnium design with silver-indium-cadmium and B_4C hybrid control rod material design applications. The advantages and disadvantages of the alternative designs are summarized, including performance and fabrication considerations.

33214 **The development of the reactor management system.** Otsuka, T.; Kawamura, A.; Netsu, N.; Niki, K.; Sakamoto, Y.; Sekimizu, K.; Yanaoisawa, A. (Nippon Atomic Industry Group Company, Ltd., 4-1, Ukishima-cho Kawasaki-ku, Kawasaki-shi, Kanagawa-ken 210). *Nuclear Technology;* **59**: No. 2, 199-211(Nov 1982).

The Reactor Management System (RMS), an on-line system with a minicomputer, has been in operation at a boiling water reactor (BWR) nuclear power plant since 1977. The objectives of this system are to perform detailed monitoring and prediction of the core status and to make reactor operation more efficient, simpler, and easier. One of the features of the system is that the RMS utilizes process computer calculated data (such as power distribution and exposure distribution in the core) transferred through the data link, as well as the plant data (such as local power range monitor readings and control rod positions) transferred through the process input/output system. Based on operational experience at the BWR plant, calculation models have been improved to achieve higher accuracy, and new functions have been added to fulfill the operator's demands. The system has now become a useful tool for the operator. For instance, the power level prediction function has become essential for plant operation at the control rod pattern change.

33215 **Neutron diffusion in graphite poisoned with 1/v and non-1/v absorbers.** Malik, U.; Kothari, L.S.; Kumar, A. (University of Delhi, Department of Physics and Astrophysics Delhi-110007). *Nuclear Science and Engineering;* **81**: No. 1, 137-143(May 1982).

Neutron diffusion in graphite containing 1/v and non-1/v absorbers has been studied in the diffusion theory approximation using a multigroup (30-group) approach and the neutron scattering kernel proposed earlier by the authors. It is observed that, in this case as in the case of water investigated earlier, the behavior of neutrons in graphite poisoned with gadolinium is different from that in graphite poisoned with samarium or cadmium. To explain the reason for this difference, a hypothetical model for the energy variation of the absorption cross section has been constructed that closely resembles samarium in one limit and goes over to gadolinium in the other. The effect of varying the concentration of non-1/v absorbers on the flux of sub-Bragg and epicold neutrons has been studied for this model, and some interesting results are obtained.

33216 **Load follow simulation of three-dimensional boiling water reactor core by PACS-32 parallel microprocessor system.** Hoshino, T.; Shirakawa, T. (University of Tsukuba, Institute of Structural Engineering Sakura-mura, Niiharigun, Ibaraki-ken 305). *Nuclear Technology;* **56**: No. 3, 465-477(Mar 1982).

The three-dimensional boiling water reactor (BWR) core following the daily load was simulated by the use of the processor array for continuum simulation (PACS-32), a newly developed parallel microprocessor system. The PACS system consists of 32 processing units (PUs) (microprocessors) and has a multiinstruction, multidata type architecture, being optimum to the numerical simulation of the partial differential equations. The BWR core model includes the modified twogroup finite difference, coarse-mesh model for neutronics, steady-state model for thermohydraulics, criticality control by core coolant flow, and the time-dependent solution of iodine-xenon dynamics with constant flux level. The analysis of the parallel processing program revealed that the overhead is independent from the number of PUs and that the efficiency of PUs, i.e., the ratio of effective calculation over total, amounts to 75%, even up to 90% if it is limited to the core part. Simulation was made on the daily load follow for 144 h including the weekend, which took 1.3 central processing unit hours by the PACS system. The PACS system demonstrated a computation speed nearly one-tenth that of the large-scale high-speed general purpose computer, with a 25 times better cost performance ratio and showed that the system could be used as the pratical BWR core simulator with more complicated core models.

33217 **A generalized likelihood ratio approach to detecting and identifying failures in pressurizer instrumentation.** Tylee, J.L. (EG & G Idaho, Inc. P.O. Box 1625 Idaho Falls, Idaho 83415). *Nuclear Technology;* **56**: No. 3, 484-492(Mar 1982).

The generalized likelihood ratio (GLR) technique performs statistical tests on the innovations sequence of a Kalman filter state estimator. Using the results of these tests, failures in the sensors of a pressurized water reactor pressurizer are detected and identified. A third-order, linear model of the pressurizer dynamics, which is required by both the GLR and Kalman filter formulations, is developed from first principles. Using actual pressurizer data, the GLR method is employed to identify a bias in one of three level sensors.

33218 **Instrument fault detection in a pressurized water reactor pressurizer.** Clark, R.N.; Campbell, B. (University of Washington FT-10 Electrical Engineering Department, Seattle, Washington 98195). *Nuclear Technology;* **56**: No. 1, 23-32(Jan 1982).

A technique of functional redundancy (as opposed to hardware redundancy) for detecting incipient failures in process instruments is applied to a simulation of the loss-of-fluid test pressurizer. The failure detection scheme consists of a set of five Kalman filters and a logical means for combining estimated state variables with instrument signals to produce decision functions, which identify faults, as they occur, in each of five instruments. Test data from the simulated plant show that prompt detection of both bias faults and high noise faults is possible during small transient fluctuations in the pressurizer from its nominal operating state.

33219 **Radiation damage by high-energy neutrons.** Primak, W. (Argonne National Laboratory 9700 South Cass Avenue, Argonne, Illinois 60439). *Nuclear Science and Engineering;* **73**: No. 1, 29-34(Jan 1980).

Graphite rods and vitreous silica blocks were exposed to the neutrons generated in a spallation source having a large flux component in the 100-MeV region. The electrical conductivity of the former and the dilatation of the latter were measured. The ratio of the damage rate in silica to that in graphite exceeded that reported for fission neutrons, and this is attributed to the scattering cross sections of carbon falling more in the neutron highenergy region than do those of silicon and oxygen. Within the authors' knowledge of the fluxes and their spectra and the yield functions, no great enhancement of the damage rate is found as compared to that which would be calculated from simple isotropic scattering.

33220 **Markovian reliability analysis under uncertainty with an application on the shutdown system of the Clinch River Breeder Reactor.** Papazoglou, I.A.; Gyftopoulos, E.P. (Massachusetts Institute of Technology, Nuclear Engineering Department Cambridge, Massachusetts 02139). *Nuclear Science and Engineering;* **73**: No. 1, 1-18(Jan 1980).

A methodology for the assessment of uncertainties about reliability of nuclear reactor systems described by markov models is developed, and the uncertainties about the failure probability of the shutdown system of the Clinch River Breeder Reactor (CRBR) are assessed. Failure and repair rates and all other inputs of reliability analysis are taken as random variables with known probability distribution functions (pdf's). The pdf of reliability is calculated by both a Monte Carlo simulation and a Taylor series expansion approximation. Three techniques are developed to reduce the computational effort: ordering of system states, merging of Markov processes, and judicious choice of time steps. A Markov model has been used for reliability analysis under uncertainty of the shutdown system of the CRBR. It accounts for common-cause failures, interdependences between unavailability of the system and occurrence of transients, and inspection and maintenance procedures that depend on the state of the system and that include possibility of human errors. Under these conditions, the failure probability of the shutdown system differs significantly from that computed without common-cause failures, human errors, and input uncertainties.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 33336, 33455

33221 **(INIS-mf—8918) Act No. 8 of 10 January 1983 amending Act No. 393 of 2 August 1975 on requirements for the siting of nuclear electricity-generating plants.** (Italian Government, Rome). 14 Jan 1983. 2p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780377.

This Act provides for the allocation of contributions to Communes and Regions where electricity-generating plants (with the exception of those fuelled by hydrocarbons) are located. The licensing procedure for siting of nuclear power plants under Act No. 393 of 2 August 1975 has now been amended. This new Act provides for intervention by the Interministerial Committee for Economic Planning (CIPE) in the determination of sites for nuclear power plants in Regions in cases where the latter have not determined a location within the time-limit prescribed by the 1975 Act. (NEA).

33222 **Environmental gamma-ray measurement methods for French nuclear installation impact studies.** Gauthier, D.; Bourdeau, F.; Caput, C. (Commissariat a l'Energie Atomique, DPr/SERE/CEN.FAR B.P. No. 6, 92260, Fontenay aux Roses). *Nuclear Technology;* **57**: No. 1, 50-57(Apr 1982).

Due to the development of the nuclear industry and current concern for the environment, studies need to be carried out on the impact of new nuclear power plants. One of the elements of this impact is external irradiation, which should be measured before installations are put into operation. Four measurement devices are compared: a scintillometer using a composite crystal, which takes into account the photon ionization power as a function of the energy (SCINTOMAT 6134 BEFIC); a tissue equivalent ionization chamber with magnesium fluoride polyethylene walls (CET 72 SAPHYMO-SRAT); a big ionization chamber filled with air at atmospheric pressure (CD 43 ALCATEL); and a pressurized gas ionization chamber made of a 25.4-cm-diam sphere containing argon at a 25-atm pressure STP (RSS 111 Reuter Stokes). For purposes of environmental measurements, the most important criteria of comparison are sensivity, relative fluctuation, and velocity of response, so that low dose rates can be measured when the device is set up in a truck moving at low speed for regional mapping. The comparison shows that the pressurized gas ionization chamber comes the closest to meeting the required conditions.

33223 **Monitoring krypton-85 during Three Mile Island Unit 2 purging.** Jester, W.A.; Baratta, A.J. (The Pennsylvania State University, University Park, Pennsylvania 16802). *Nuclear Technology;* **56**: No. 3, 478-483(Mar 1982).

The Penn State noble gas monitor played an important role in measuring environmental levels of ^{85}Kr during the purging of the Three Mile Island Unit 2 primary containment. It filled a gap in the U.S. Environmental Protection Agency monitoring program, which existed between their real time monitors and their cryogenic gas chromatographic separation technique. During the 15-day purging period, the system analyzed a total of 124 samples, of which 37 were quantified to contain ^{85}Kr in concentrations ranging from 3×10^4 to 1.5×10^6 pCi/m^3. The maximum whole body beta dose rate was found to be 0.28 mrem/h.

33224 **Photon point source buildup factors for air, water, and iron.** Chilton, H.B.; Eisenhauer, C.M.; Simmons, G.L. (University of Illinois at Urbana-Champaign Nuclear Engineering Program, Urbana, Illinois 61801). *Nuclear Science and Engineering;* **73**: No. 1, 97-107(Jan 1980).

Buildup factors for photons in infinite homogeneous samples of air, water, and iron have been calculated by a moments method code. The photons were assumed to be emitted from a point source. Comparisons of these results to values obtained earlier, both by experiment and by calculation, show reasonable agreement except in some instances of deep penetration. The parameters in the Berger empirical formula for buildup factors have been evaluated from the present work. The Berger formula is shown to fit the calculational results for nuclei of low atomic number at energies above 1 MeV and below 0.06 MeV. In mid-energy range, differences of as much as 40% are observed. The formula appears to provide excellent fit to the data for nuclei of medium atomic number.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 33351, 34132

33225 **(ECN—138) Fast reactor programme. Annual progress report 1981.** Plakman, J.C. (Stichting Energieonderzoek Centrum Nederland, Petten). 1983. 110p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84702051.

Microfiche only, copy does not permit paper copy reproduction. Original copy available until stock is exhausted3 figs., 63 refs., 11 tables.

This progress report summarises the fast reactor research carried out at the Netherlands Energy Research Centre during the year 1981. The neutron and fission product cross sections of various isotopes have been evaluated. In the fuel performance programme, some preliminary results are given and irradiation facilities described. Creep experiments on various stainless steel components are reported.

33226 (INIS-BR—95, pp 210-219) **Neutronic analysis of a fast-thermal coupling in Argonaut reactor at IEN (Nuclear Engineering Institute).** Bastos, W.S.; Brito Aghina, L.O. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1982. (In Portuguese). NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780120.

In 3. National Meeting of Reactor Physics.

The viability of an thermal-fast coupling project for Argonaut type reactor, at IEN (Instituto de Engenharia Nuclear) is presented. (E.G.).

33227 (INIS-BR—119, pp 117) **Determination of the better composition for Argonaut fuel elements.** Dutra, P.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33228 (INIS-BR—120, pp 234-239) **Corrosion of zircaloy fuel pins.** Goncalves, A.C.; Goncalves, Z.C. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

The corrosion tests, aiming to verify the possibility of the use zircaloy-4, from Argentina, in the Argonaut fuel pins, are described. (E.G.).

33229 (INIS-BR—120, pp 90) **Reactor instrumentation.** Koyama, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33230 (INIS-BR—120, pp 151-152) **Study of the powder granulometry effect on calcination and compacting of Argonaut reactor fuel rods.** Dutra, P.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

The several compositions of the U_3O_8, bakelite and graphite, in function of the powder granulometry, are studied. (E.G.).

33231 (INIS-BR—120, pp 200-201) **Determination of Argonaut neutron temperature by integral measure of total cross sections and differential measure of neutron velocity density distribution.** Voi, D.L. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33232 (INIS-BR—120, pp 204) **New fuel elements for Argonaut type reactor.** Brito Aghina, L.O. de; Dutra, P.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33233 (INIS-mf—8976) **Annual report 1982.** (Stichting Energieonderzoek Centrum Nederland, The Hague). Jun 1983. 87p. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84702049.

This annual report gives a survey of the activities of ECN at The Hague and Petten, Netherlands, in 1982. These activities are concerned with energy generation and development and with scientific and technical applications of thermal neutrons, which are available from the High Flux Reactor and the Low Flux Reactor at Petten. The Energy Study Centre (ESC), a special department of ECN, is engaged with social-economic studies on energy generation and utilization. ESC also investigates the consequences of energy scenarios. The Bureau Energy Research Projects (BEOP) coordinates and administers all national research projects, especially on flywheels, solar energy, wind power and coal combustion. After a survey of staffing and finances the report ends with a list of ECN publications.

33234 (ORNL—6058) **Preanalysis calculations of the US/UK joint experiment in the Dounreay prototype fast reactor.** Broadhead, B.L.; Gove, N.B.; Raman, S. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013569.

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The United States and the United Kingdom are engaged in a joint research program in which samples of the higher actinides are irradiated in the Dounreay Prototype Fast Reactor in Scotland. Purpose is to study the materials behavior of selected higher actinide fuels and to determine the integral cross sections of a wide variety of the higher actinide isotopes. Samples of the actinides are incorporated in fuel pins inserted in the core. For the fuel study, the actinides selected are ^{241}Am and ^{244}Cm in the form of Am_2O_3, Cm_2O_3, and $Am_6Cm(Re)_7O_{21}$, where (RE) represents a mixture of lanthanides. For the cross-section determinations, the samples are milligram quantities of actinide oxides of ^{248}Cm, ^{246}Cm, ^{244}Cm, ^{243}Am, ^{241}Am, ^{244}Pu, ^{242}Pu, ^{241}Pu, ^{240}Pu, ^{239}Pu, ^{238}Pu, ^{237}Np, ^{238}U, ^{236}U, ^{235}U, ^{234}U, ^{233}U, ^{232}Th, ^{230}Th, and ^{231}Pa encapsulated in vanadium. This report describes the calculational activities being performed in preparation for the post-irradiation analysis of the discharged samples. In particular, the calculational results presented are estimates of the irradiation products expected to be present in the first experimental pin discharged from the reactor.

33235 (ORNL/TM—9205) **Oak Ridge Research Reactor quarterly report, October, November, and December 1983.** Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012706.

The ORR operated at an average power level of 29.2 MW for 87.3% of the time during October, November, and December of 1983. The reactor was shut down on nine occasions, three of which were unscheduled. Reactor downtime needed for refueling and checks was normal. The reactor remained available for operation 91.4% of the time. Maintenance activities, both mechanical and instrument, were essentially routine in nature with the exception of two Reactor Instrumentation and Controls Design Change memorandums. In-service inspection completed during the quarter included the inspection of the ORR pool window.

33236 (ORNL/TM—9214) **Bulk Shielding Facility quarterly report, October, November, and December 1983.** Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013480.

The BSR operated at an average power level of 443 kW for 0.09% of the time during October, November, and December 1983. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The PCA was used in training programs and was operated on one occasion when the University of Kentucky students actively participated in training laboratories.

33237 **Developments in electrochemical oxygen meter probes for use in liquid sodium.** Barton, G.B.; Keough, R.F.; McCown, J.J.; Yount, J.A. (Hanford Engineering Development Laboratory P.O. Box 1970, Richland, Washington 99352). *Nuclear Technology;* **57**: No. 3, 315-319(Jun 1982).

A program was carried out to develop small less fragile ceramic electrodes for use in measuring oxygen in sodium. To use the electrodes as inserts in existing sampler hardware, composite metal-ceramic tubes were required. Four configurations of composite metal-ceramic probes employing yttria-doped thoria as the solid electrolyte were fabricated and tested. These incorporated both mechanical and brazed seals between the metal and ceramic. The most useful for fast flux test facility applications utilized a brazed seal between the ceramic and an alloy of matching coefficient of thermal expansion. A number of alternate reference systems were also investigated. Reference electrodes tested included Na-Na_2O, In-In_2O_3, Ni-NiO, and Ag-air.

33238 **Sensitivity and uncertainty analysis of the Coupled Fast Reactivity Measurements Facility central flux spectrum.** Ryskamp, J.M.; Andrel, R.A.; Broadhead, B.L.; Ford, W.E.; Lucius, J.L.; Marable, J.H.; Wagschal, J.J. (EG & G Idaho, Inc. P.O. Box 1625, Idaho Falls, Idaho 83415). *Nuclear Technology;* **57**: No. 1, 20-35(Apr 1982).

The Coupled Fast Reactivity Measurements Facility (CFRMF) is a zoned-core critical assembly with a fast neutron spectrum zone in the center of an enriched ^{235}U, water-moderated thermal driver. The central neutron field is a Cross-Section Evaluation Working Group benchmark for data testing of fission product, actinide, and dosimetry cross sections important to fast reactor technology. The AMPX and FORSS code systems were used to determine a covariance matrix for the CFRMF central neutron spectrum. The covariance matrix accounts for neutron cross section and fission spectrum uncertainties and correlations. Uncertainties in the ^{238}U inelasticscattering cross sections and in the ^{235}U fission spectrum were found to contribute most to the standard deviations in the central flux spectrum. The flux-spectrum covariance matrix contains strong correlations. This strongly motivates including the off-diagonal elements in data testing and cross section adjustment applications. The flux spectrum covariance matrix was applied in this work for integral data testing for dosimeter cross sections.

33239 **Development of high-uranium loaded U_3O_8-Al fuel plates.** Copeland, G.L.; Martin, M.M. (Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, Tennessee 37830). *Nuclear Technology;* **56**: No. 3, 547-552(Mar 1982).

A common plate-type fuel for research and test reactors is U_3O_8 dispersed in aluminum and clad with an aluminum alloy. There is an impetus to reduce the ^{235}U enrichment from above 90% to below 20% for these fuels to lessen the risk of diversion of the uranium for nonpeaceful uses. Thus, the uranium content of the fuel plates has to be increased to maintain the performance of the reactors. Work at Oak Ridge National Laboratory has determined the maximal uranium loading for these fuels that can be fabricated with commercially proven materials and techniques and that can be expected to perform satisfactorily in service. Assuming satisfactory performance in irradiation tests to the required burnup, the author, anticipate being able to increase the uranium loading in U_3O_8-Al dispersions to the 3.1 Mg U/m^3 level (75 wt% U_3O_8). This loading level will allow many research reactors to be fueled by uranium of $<20\%$ enrichment.

33240 **Fast-neutron hodoscope at TREAT: methods for quantiative determination of fuel dispersal.** De Volpi, A.; Fink, C.L.; Marsh, G.E.; Rhodes, E.A.; Stanford, G.S. (Argonne National Laboratory Reactor Analysis and Safety Division, Argonne, Illinois 60439). *Nuclear Technology;* **56**: 141-188(Jan 1982).

For fuel-motion surveillance in Transient Reactor Test Facility experiments, the fast-neutron hodoscope has advanced beyond its initial ability to provide time, location, and velocity data: its quantitative mass results are now routinely used in liquidmetal fast breeder reactor accident projections. (Mass normalization is based on initial fuel inventory.) The material and radiation surroundings of the test section affect hodoscope detectors in intrinsic and instrumental ways that necessitate detailed corrections. Depending on the experiment, count rate compensation with as little as 5% total imprecision is usually desired for dead time, power-level changes, nonlinear response, efficiency, and background. In addition, systematic effects ranging up to 20% may occur, from such causes as self-shielding, self-multiplication, self-attenuation, and flux depression. For one- to seven-pin bundles, the hodoscope has achieved 1-ms time resolution, 0.25-mm lateral- and 5-mm axial-motion displacement detection, and 50mg single-pin, 350-mg seven-pin mass resolution-not all, however, simultaneously, since resolution and statistical precision are inversely related. The experimental and theoretical foundation for that performance is now well established.

33241 **Neutron and gamma-ray penetrations in thick iron.** Oka, Y.; An, S.; Kasai, S.; Koyama, K.; Miyasaka, S. (The University of Tokyo, Nuclear Engineering Research Laboratory The Faculty of Engineering, Tokai-mura, Ibaraki 319-11). *Nuclear Science and Engineering;* **73**: No. 3, 259-273(Mar 1980).

Measurements of neutron and gamma-ray penetrations in an iron shield were performed up to a 60-cm depth in a tightly coupled source shield configuration with the fast-neutron reactor YAYOI as a source. Rates of neutron reactions and gamma-ray dose rates in the iron shield were obtained using activation foils and thermoluminescent dosimeters. Analyses of the experiments were made by using the DOT-III code with coupled neutron and gamma-ray cross sections from ENDF/B-IV and POPOP4 libraries. To obtain the source condition for the iron shield analyses, the calculated spectrum was adjusted to the measured reaction rates at the reactor shield boundary. The calculated neutron and gamma-ray distributions in the iron shield show fairly good agreement with the experiments. The effect of difference in Bondarenko-type self-shielding factors on the analyses of the iron shield is also shown.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 32696, 33258, 33259, 33260

33242 **(DPST—72-428) Thermal discharges from the Savannah River Plant.** Brown, R.J.; Jacobsen, W.R.; Rabon, E.W.; Tilly, L.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Sep 1972. Contract AC09-76SR00001. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013157.

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The nuclear production reactors at the AEC's Savannah River Plant, located by siting requirements, utilize on-site natural watercourses, swamps, and cooling water impoundments to dissipate heat in effluent cooling water. Stream-swamp cooling is the most efficient and economical cooling mechanism available to the two reactors presently using this method of heat dissipation. The effects on the Savannah River of high temperature water discharged from the reactors are thus minimized, and detrimental environmental consequences are confined to the plantsite. A large cooling water impoundment, which is currently being used to dissipate heat from one reactor, has furnished an extensive area for biological research into the effects on the aquatic community resulting from its varied thermal conditions.

33243 **(DPST—80-445-Del.Ver.) Neutron fluence in P,K reactor tank walls.** Gorrell, T.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1 Oct 1980. Contract AC09-76SR00001. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013176.

The neutron fluence (phi t) accumulated by the P,K reactor tank walls over 26 years of operation was calculated, for use in evaluating the possible deleterious effects of neutron irradiation. Fast neutrons can change the yield and ultimate strength, the hardness and the ductility of stainless steel. Thermal neutrons transmute atoms of one element of stainless steel (Cr, Mn, Fe, Ni) to another element, and thereby alter the metallurgical properties of the alloy. Previously, only gross estimates had been made of the tank wall fluence. Improved calculations described in this memorandum have yielded results suitable for use in planned metallurgical studies. Both the fast and the thermal fluences in the C reactor tank wall are less than in P or K.

33244 **(KURRI-TR—224) Flow test for the full scale core mock-up to the KUHFR, (2). Flow-induced vibrations of the core.** Mishima, Kaichiro; Araki, Yasusuke; Ishikawa, Yoshiaki. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 6 May 1981. 64p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84702037.

The Research Reactor Institute, Kyoto University, has carried out a variety of research and development in support of the high flux reactor (KUHFR) project. As for the thermal-hydraulic design of the reactor core, the flow test with a full scale mock-up of the core was performed in order to verify the design calculation. This report shows the result of measurement of the vibration of the core vessel and core itself obtained during the flow test. The flow rate through the core mock-up reached up to 1920 m^3/h, which is approximately 1.3 times as much as the normal flow rate. Non-contact displacement sensors and piezoelectric accelerometers were used to measure the vibration of the core vessel, core components and outer fuel elements. The traces of the vibration were reproduced on charts to read the maximum amplitude. The data were analyzed to find the characteristics of the vibration. The observations of the corrosion and deformation of the components were made. The results obtained are as follows. The vibration of the core vessel was excited by coolant flow. The predominant frequency was about 7 Hz, which is nearly equal to that of the free vibration of the core vessel. The maximum displacement was 300 μm, and the maximum acceleration was 1.8 g.

33245 **(KURRI-TR—228) Report on material tests and mock-up tests for fabrication of the KUHFR reflector tank.** Yoshida, Hiroyuki; Araki, Yasusuke; Mitani, Shigefumi; Achiwa, Norio; Kawano, Shinji. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1982. 78p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84702038.

The Kyoto University high flux reactor (KUHFR) is designed to have a pair of cylindrical core vessels made of aluminum A 6061 and a spherical reflector tank made of stainless steel SUS 316 L containing the core vessels. The cooling and moderating light water flows downward. The reflector tank is filled with heavy water which is a good neutron moderator to offer a proper thermal neutron field for various irradiation and beam experiments. Many kinds of the test on SUS 316 L specimens treated under various conditions were carried out, such as metallographic microstructure observation, mechanical test and corrosion test. The results are summarized as follows. Most of the specimens showed good microstructure and excellent Huey corrosion resistance. The zone with reduced Cr at grain boundary was not observed in the specimens treated above 920 deg C. The specimens prepared after a commercial plate was treated according to the normal fabrication procedure showed good mechanical properties. A mock-up of actual size with typical nozzles was made of SUS 316 L plates and pipes. After the actual heat treatment, the change of the size and shape, residual stress, microstructure and corrosion resistance were examined to establish the fabrication procedure and heat treatment.

33246 **(ORNL/TM—9222) High Flux Isotope Reactor. Quarterly report, January-March 1984.** Dahl, T.L.; Farrar, M.B. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012667.

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Routine reactor operation with three end-of-cycle shutdowns and four unscheduled shutdowns resulted in an on-stream time of 85.1% for the quarter. Three of the unscheduled shutdowns occurred during the first week of operation following the three-month major overhaul. The causes were (1) dropped rod, (2) primary

relief system leakage, (3) extension-tube piston drop, and (4) pressure balance system leaks. In addition, leaks were repaired on the Cell 110 heat exchanger tube and letdown line, and refurbishment of the secondary cooling pumps was continued. There were no radiological environmental or industrial-related incidents or injuries during the quarter.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 32761

33247 **(ANL/LWR/SAF—84-1) Hydrodynamic sweepout thresholds in BWR Mark III reactor cavity interactions.** Spencer, B.W.; Baronowsky, S.P.; Kilsdonk, D.J. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013937.

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Simulant-material experiments and related analysis are described which investigated hydrodynamics aspects of ex-vessel interactions following postulated core meltdown with subsequent meltthrough of the vessel lower head and ejection of molten corium from the vessel into the containment region beneath the vessel. Objectives were to examine the possible sweepout of water and corium from the cavity by the steam/H_2 flow. The dispersal pathways in this containment design include a single manway and four CRD penetrations in the cylindrical pedestal wall connecting to the drywell with a combined cross-sectional area of $\sim$ 10 m^2. These openings range from 3.4 to 6.3 m in elevation off the concrete floor of the cavity. The experiments were performed using a 1:34 scale mock-up of the RPV/pedestal region. The first tests were quasi-steady tests. Tests were also performed using molten Wood's metal (WM). Some tests were performed with water on the cavity floor, and one test was performed using steel shot. The test results indicated that threshold gas flowrates existed beyond which dispersal of water and/or corium from the cavity can be expected. The predominant dispersal flow regime observed in the experiments involved fluidization of the water or molten WM by the gas flowrate through the system and sweepout of the fluidized liquid droplets as the gas exited the cavity through the openings in the wall. The superficial gas velocity at the onset of water sweepout ranged from 0.87 to 1.04 m/s in the tests which agrees very closely to the calculated fluidization threshold of 0.96 m/s. Application of the fluidization model for prediction of sweepout for the full-size system suggests that sweepout of water and corium can occur if the breach size in the RPV lower head exceeds $\sim$ 10 and 17 cm dia, respectively, for steam blowdown at a vessel initial pressure of 1000 psi.

33248 **(BMI—1983-017) Reaction of the core melt with various rock types.** Hassmann, K. (Bundesministerium des Innern, Bonn (Germany, F.R.); Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Nov 1983. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751478.

For evaluation of the long-term differences to be expected from the reaction of molten core material with various types of rocks, in connection with nuclear power plants built in rocky caverns, a determination was performed of the integral melt enthalpy, specific heat capacity, heat conductivity, density as well as the gases released up to the melting point of representative samples of new red sandstone, granite and slate. The integral melt enthalpies as well as the specific heat capacities show similar magnitudes each, while density and heat conductivity as well as gas release show wide differences.

33249 **(BMI—1983-018) Expansion of core melt within the concrete foundation - effects on the reactor building structure.** Hassmann, K.; Liphardt, W.; Bindseil, P. (Bundesministerium des Innern, Bonn (Germany, F.R.); Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Nov 1983. 81p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751429.

The effects of core melt expanding in the concrete fundament of underground-situated nuclear power plants on the structure of the reactor building have been investigated. The radial reduction of the foundation plate is not to exceed 12 m, in case limited additional internal pressure loads of more than 6 bar are to be covered. Greater reductions will endanger the stability of the building. For the assumed load cases, no penetrating cracks will occur. During the subject test, the limiting walls of the building remained leakproof up to an internal pressure of 2.5 bar.

33250 **(BNL-NUREG—34545) Development of methods to predict both the dynamic and the pseudo-static response of secondary structures subjected to seismic excitations.** Subudhi, M.; Bezler, P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 5p. (CONF-840833—3). NTIS, PC A02/MF A01; 1 - GPO; GPO Dep. Order Number DE84010284.

From 5. American Society of Civil Engineers/Engineering Mechanics specialty conference; Laramie, WY, USA (1 Aug 1984).

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Multiple independent support excitation time history formulations have been used to investigate simplified methods to predict the inertial (or dynamic) component of response as well as the pseudo-static (or static) component of response of secondary structures subjected to seismic excitations. For the dynamic component the independent response spectrum method is used with current industry practice for the modal and direction of excitation combinations being adopted and various procedures for the group combination and sequence being investigated. SRSS combination between support groups is found to yield satisfactory results. For the static component, support grouping by elevation for preliminary design followed by support grouping by attachment point for final design assure overall safety in the design.

33251 **(CONF-780805—9) Fragmentation of UO_2 and UC drops entering a sodium pool.** Ganguli, A.; Bankoff, S.G. (Northwestern Univ., Evanston, IL (USA)). 1978. Contract AC02-76ET37210. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013201.

From 6. heat transfer conference; Toronto, Canada (7 Aug 1978).

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In this paper attention is focussed on whether coarse premixing of fuel and coolant is possible according to the jet penetration hypothesis, with applications to a hypothetical accident in a liquid metal cooled nuclear reactor. For UO_2 or UC fuel drops entering a sodium pool, the rapid bubble growth and collapse phenomenon, followed by crust breakup due to jet penetration, is analyzed as a function of the system pressure and coolant temperature. It appears that the UO_2-Na system fragments rapidly upon contact, for coolant temperatures above 300°C, while the corresponding temperature for the carbide fuel is around 600°C, at atmospheric pressures. For UO_2 but not for UC, there is a cut off pressure in the 0.1 to 3 MPa range, above which the crust does not break up for a particular coolant temperatures between 400 and 800°C. Higher sodium temperatures aid the breakup for both fuels. One concludes that coarse premixing for UO_2, but not necessarily for UC, is difficult to attain.

33252 **(CONF-790816—105) Fuel-coolant interaction in a shock tube with initially-established film boiling.** Sharon, A.; Bankoff, S.G. (Northwestern Univ., Evanston, IL (USA). Dept. of Chemical Engineering). 1979. Contract AC02-76ET37210. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013202.

From International meeting on fast reactor safety technology; Seattle, WA, USA (19 Aug 1979).

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A new mode of thermal interaction has been employed, in which liquid metal is melted in a crucible within a shock tube; the coolant level is raised to overflow the crucible and establish subcooled film boiling with known bulk metal temperature; and a pressure shock is then initiated. With water and lead-tin alloy an initial splash of metal may be obtained after the vapor film has collapsed, due primarily to thermal interaction, followed by a successive cycle of bubble growth and collapse. To obtain large interactions, the interfacial contact temperature must exceed the spontaneous nucleation temperature of the coolant. Other cutoff behavior is observed with respect to the initial system pressure and temperatures and

with the shock pressure and rise time. Experiments with butanol and lead-tin alloy show only relatively mild interactions. Qualitative explanations are proposed for the different behaviors of the two liquids.

33253 **(CONF-840701—13) Mass spectrometric study of the release of volatile fission products from irradiated LWR fuel.** Johnson, I.; Steidl, D.V.; Johnson, C.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013424.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

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The objective of these studies is to experimentally determine the chemical form and the rate of release of volatile fission product species from defected irradiated LWR reactor fuel pins. After release from the defected fuel pin the gaseous species immediately enters the ionizer of a quadrupole mass spectrometer thus ensuring that their chemical form is not likely to be changed prior to identification and measurement. These studies differ from prior studies in that: (1) the chemical form of the volatile fission products will be determined; and (2) the detection and measurement method does not depend on the radioactivity of the fission product element. Information on the chemical form of the released fission product species will enable a more accurate description of their transport and reaction in the primary system. These studies are also expected to yield information on the reaction of fission products after release from the fuel oxide with the zircaloy cladding. The results of these studies are expected to increase the understanding of the first step in the release of fission products by irradiated fuel and therefore help in the accurate prediction of source terms.

33254 **(CONF-840816—6) Flashing and jet impinging condensation during a postulated sodium blowdown accident of an experiment loop in a test reactor cavity.** Wang, C.S.; Chuang, C.F. (Argonne National Lab., IL (USA)). Aug 1984. Contract W-31-109-ENG-38. 21p. NTIS, PC A; 3; GPO Dep. Order Number DE84006593.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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A study on flashing and jet impinging condensation has been made and applied to the analysis of reactor sodium blowdown accident. Results show that part of the liquid may flash into a vapor state at the exit of the breach during the accident. The existence of this vapor affects the sodium flow rate significantly. Results also show that the subsequent impingement of two-phase sodium onto the adjacent surfaces will increase the heat transfer to the wall. The vapor condensation can significantly reduce the amount of sodium vapor reaching the reactor cavity. The theoretical approach of the present study can also be used for other engineering applications.

33255 **(CONF-840816—7) Calculation of sample problems related to two-phase flow blowdown transients in pressure relief piping of a PWR pressurizer.** Shin, Y.W.; Wiedermann, A.H. (Argonne National Lab., IL (USA); ATResearch Associates, Glen Ellyn, IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006739.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

A method was published, based on the integral method of characteristics, by which the junction and boundary conditions needed in computation of a flow in a piping network can be accurately formulated. The method for the junction and boundary conditions formulation together with the two-step Lax-Wendroff scheme are used in a computer program; the program in turn, is used here in calculating sample problems related to the blowdown transient of a two-phase flow in the piping network downstream of a PWR pressurizer. Independent, nearly exact analytical solutions also are obtained for the sample problems. Comparison of the results obtained by the hybrid numerical technique with the analytical solutions showed generally good agreement. The good numerical accuracy shown by the results of our scheme suggest that the hybrid numerical technique is suitable for both benchmark and design calculations of PWR pressurizer blowdown transients.

33256 **(CONF-840833—4) Sloshing response of a reactor tank with internals.** Ma, D.C.; Gvildys, J.; Chang, Y.W. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009629.

From 5. American Society of Civil Engineers/Engineering Mechanics specialty conference; Laramie, WY, USA (1 Aug 1984).

The sloshing response of a large reactor tank with in-tank components is presented. The study indicates that the presence of the internal components can significantly change the dynamic characteristics of the sloshing motion. The sloshing frequency of a tank with internals is considerably higher than that of a tank without internal. The higher sloshing frequency reduces the sloshing wave height on the free-surface but increases the dynamic pressure in the fluid.

33257 **(DOE/ET/37210—1) Mechanisms of vapor explosions. Final report, September 1, 1976-March 31, 1984.** Bankoff, S.G. (Northwestern Univ., Evanston, IL (USA)). May 1984. Contract AC02-76ET37210. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013484.

Three areas which are relevant to the basic mechanisms of vapor explosions have been addressed, both experimentally and theortically: the destabilization of film boiling by a pressure shock wave; the basic fragmentation and mixing mechanisms once liquid-liquid contact has been achieved; the necessary conditions for a supercritical Board-Hall thermal detonation. It has been shown that shock waves of only a few bars overpressure can produce liquid-solid contacts for periods of a millisecond or more, with accompanying very high heat transfer rates, in a nickel-Freon system. The results are in agreement with a theoretical analysis demonstrating when contact is or is not established. Mixing time constants have been measured for tin-water interactions in a shock tube configuration. The predominant mode of interaction appears to be by multiple expansions and a contraction, which implies that in large scales the final contraction might give rise to a vigorous explosion. However this is not considered to be likely in the LMFBR because of the spontaneous nucleation requirement. Supercritical propagating plane detonations have been shown to be limited to a very narrow range of initial conditions, which would be very difficult to achieve in practice.

33258 **(DPST—78-545-Del.Ver.) GRASS calculation of a postulated Gang I withdrawal transient without shutdown.** Parks, P.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 19 Oct 1978. Contract AC09-76SR00001. 41p. NTIS, PC A03; 3; GPO Dep. Order Number DE84013172.

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As part of the ongoing GRASS reactor safety verification program, a reactor transient was calculated for a Gang I rod withdrawal assuming the shutdown systems were inoperative. The analysis was made for the postulated accident in C reactor at the start of a Mark 16-31A charge. This document outlines the input data used in executing the calculation, describes the results, and discusses the known uncertainties in the GRASS models.

33259 **(DPST—79-486-Del.Ver.) Comparison of GRASS and AAMZON calculations.** Smith, J.A.; Parks, P.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 14 Sep 1979. Contract AC09-76SR00001. 65p. NTIS, PC A04; 3; GPO Dep. Order Number DE84013173.

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A program is underway to compare results of reactor accidents analyzed by the sophisticated Generalized Reactor Analysis Subsystem (GRASS) with results derived from the simpler methods now used for routine analyses. The objectives of the program are to obtain the best possible descriptions of standard accidents, to demonstrate the conservatism of the simpler methods, and to derive bases for possible improvements in the simpler methods. The first result is to be accomplished (largely) by applying GRASS. (Extrapolation to alternative accident conditions probably will be done using the simpler methods.) The last two results are to be accom-

plished by conducting parallel analyses with both methods and explaining the differences. The study described in this report lays some of the groundwork for explaining differences, by comparing parallel calculations of a transient that is less complicated than most of the reactor accidents considered. It points out some of the basic differences that will be common to most of the reactor accident analyses.

33260 **(DPST—79-548) Confinement protection by automatic backup shutdown.** Smith, J.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 25 Mar 1980. Contract AC09-76SR00001. 48p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013166.

Technical Standards require maintaining the integrity of the airborne activity confinement system even if the safety rod scram system should fail during postulated rod-withdrawal and loss-of-target accidents. Arguments are presented here to show that engineered safety systems are capable of satisfying this requirement. The principal system applied is an automatic backup shutdown system utilizing the safety computers (ABS-S/C).

33261 **(EPRI-NP—3473) Pressurizer transient response: experimental data. Final Report.** Jordan, R.P. (Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering). May 1984. 187p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920375.

Pressurizer transient behavior is qualitatively examined through analysis of experimental data obtained from a scaled Freon-113 test facility. Descriptions of experimental results for tests based on the pressurizer boundary condition categories of heater input, relief flow, spray flow, surge inflow, and surge outflow are presented both as general category and individual test descriptions. Experimental data describing the scaled pressurizer response is included as the initiation of a pressurizer transient data base. Descriptions of the testing facility, data acquisition system, and instrumentation utilized are provided.

33262 **(EPRI-NP—3474) Multidimensional and two-phase flow effects in PWR core reflooding. Final report.** Ghiaasiaan, S.M.; Catton, I. (California Univ., Los Angeles (USA). Nuclear Energy Lab.). May 1984. 196p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920422.

Forced and gravity bottom reflooding experiments were carried out with a scaled 1692-rod slab core. The observations show that the overall quenching phenomena in both cases are one-dimensional and the basic thermal-hydraulic phenomena in both cases are similar. Based on experimental observations, semi-empirical and empirical methods are proposed for an approximate treatment of two-phase thermal-hydraulic and multi-dimensional effects in which flow field conservation equations are solved macroscopically. The proposed methods were incorporated in a computer code and were tested against a wide range of experimental data with favorable results.

33263 **(EPRI-NP—3493) Coupled-valve dynamic model for steam, two-phase, and subcooled discharge flow conditions. Final report.** Teske, M.E.; Bilanin, A.J.; Hecht, A.M. (Continuum Dynamics, Inc., Princeton, NJ (USA)). May 1984. 123p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920378.

Spring-loaded, self-actuating safety valves are employed as part of the overpressure protection systems in PWR nuclear power plants. In order to design and predict their performance, valve dynamic behavior must be studied over a range of fluid and system conditions. The EPRI/PWR Safety and Relief Valve Test Program collected a significant amount of experimental data on valve behavior under stable and unstable protypical dynamic conditions involving high quality steam and subcooled liquid. This report discusses a one-dimensional theoretical model developed to study the effects of different valve and system parameters influencing valve dynamic behavior benchmarked against the test program data base. The model is capable of predicting the effects of valve geometric and dynamic characteristics and upstream pipe length and diameter on performance under steam and subcooled liquid discharge conditions. Valve geometric parameters include the valve dimensions which control flow areas and disc and seat forces. The back pressure area and magnitude effects are included, as well as the set pressure and ring position effects. The analytical and empirical foundations of the valve model are documented here and comparisons are made between model simulations and the full scale test results. The theory and computer code described in the present report include the flow of high quality steam, using the isentropic ideal gas approximation, and subcooled liquid, two-phase and superheated steam using steam tables parameterized over the pressure range of interest.

33264 **(EPRI-NP—3513) Postaccident liquid sampling systems. Final report.** Davidson, G.R.; Lahti, G.P. (Sargent and Lundy, Chicago, IL (USA)). May 1984. 229p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920385.

The postaccident and routine analysis of reactor coolant water for gamma fission product activity, boron concentration, pH, and chloride ion concentration was studied. Objectives were (1) to evaluate NRC postaccident monitoring guidelines, (2) to characterize postaccident conditions, (3) to evaluate post-accident monitoring methods and equipment, and (4) to investigate improvements. These issues were explored by (1) comparing postaccident information needs in comparison with regulatory requirements, (2) calculating postaccident radioactivity concentrations, (3) assembling data on commercial postaccident monitoring systems, and (4) performing laboratory tests. Postaccident gamma spectrometry was investigated. Effects of ambient airborne radioactivity, high count rates, and count rate reduction techniques were studied. A prototype automated on-line analysis system incorporating chemical separation and sample holdup for decay was developed. Performance specifications and techniques of commercial on-line systems are assessed, and relative merits of on-line and grab sample systems are discussed. Several methods of chemical analysis were evaluated. For boron, these were titration of the mannitol-borate complex, potentiometry with Na^+ and H^+ ion-selective electrodes, and a method not yet commercially used for reactor coolant, spectrophotometry with the reagent azomethine; for pH, potentiometry with the glass electrode; and for chloride ion, ion chromatography and potentiometry with the chloride ion-selective electrode. While most of the methods satisfied NRC guidelines, the performance of some was marginal.

33265 **(EPRI-NP—3519) Development of an analytic model to determine pump performance under two-phase flow conditions. Final report.** Furuya, O. (Tetra Tech, Inc., Pasadena, CA (USA)). May 1984. 67p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920381.

During a hypothetical LOCA (loss of coolant accident), the recirculating coolant of PWR (pressurized water reactor) may flash into steam due to a loss of line pressure. Under such two-phase flow conditions, it is well known that the recirculation pump becomes unable to generate the same head as that of the single-phase flow case. Based on the one dimensional control volume method, an analytical method has been developed to determine the performance of pumps operating under two-phase flow conditions. The analytical method has incorporated pump geometry, void fraction, flow slippage and flow regime into the basic formula, but neglected the compressibility and condensation effects. During the course of model development, it has been found that the head degradation is mainly caused by higher acceleration on liquid phase and deceleration on gas phase than in the case of single-phase flows. The numerical results for head and torque degradations were obtained with the model and favorably compared with the test data of air/water two-phase flow pumps of Babcock and Wilcox (1/3 scale) and Creare (1/20 scale).

33266 **(GEND—035) Submerged demineralizer system vessel shipment report.** Quinn, G.J.; Henrie, J.O.; Greenborg, J. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1984. Contract AC07-76ID01570. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013866.

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Vessels containing zeolites and absorbed fission products from processing accident-generated water at Three Mile Island

through the Submerged Demineralizer System were found to generate radiolytic hydrogen and oxygen gases. In some vessels with high curie contents, gas generation during shipment could have resulted in flammable gas concentrations exceeding federal limits for radioactive material shipments. Tests of a catalyst bed in the vessel demonstrated that recombination of the gases back into water would permit safe shipment of the sealed vessels. Catalyst was loaded into an available screen assembly in each vessel. Vessel pressure monitoring ensured that net gas generation had stopped and that hydrogen and oxygen concentrations were kept below flammable limits. All shipments complied with federal regulations.

33267 **(GEND—040) Final report on the in situ testing of electrical components and devices at TMI-2.** Soberano, F.T. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Jun 1984. Contract AC07-76ID01570. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014163.

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A total of 88 electrical components and devices were in situ tested. Of these, 11 totally failed and 21 suffered degradation that varied from mild to severe. The equipment that failed or incurred severe degradation was located in areas of known environmental extremes. Several motor operated valves in the Reactor Building basement failed because of submersion in water. Others severely degraded from contamination tracking, resulting in the alteration of their circuit electrical characteristics - a circumstance that could compromise their designed function. One backup oil lift pump motor for a reactor coolant pump motor, although located well above the Reactor Building basement high water mark, failed because of a break in its armature and field circuits; this failure was surmised to be a result of corrosion. The limit switch of a Class 1E solenoid valve likewise failed due to moisture intrusion. Components that noticeably degraded exhibited anomalies, likely due to the incursion of moisture, that varied from high capacitance to increased circuit resistance. The effect of the other degenerating conditions that existed during the accident, such as high temperature, high radiation levels, and the hydrogen burn, could not be evaluated individually or synergistically.

33268 **(GKSS—83/E/58) Installation of an infrared measuring device in pressure release phenomena.** Sakkal, F. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751492.

To analyze the saturated steam density and infrared measuring device was installed in a large scaled test facility. The possibility of accurate measuring of the density of two phase-two component flow and the ability to a rapid reaction on density oscillation are emphasized. In addition, the device allows an exact analysis of the density in two phase-two component flow with detailed information about the nature of condensation phenomena.

33269 **(GKSS—83/E/59) Investigation of sodium concrete interaction and the effect of different by-products.** Schultheiss, G.F.; Fritzke, H.W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 14p. (CONF-8307118—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751493.

From 1. international conference on the use of fly ash, silica, fume and other mineral by-products in concrete; Montebello, Canada (31 Jul 1983).

For heat transfer at temperatures of more than 770 K sodium or sodium-potassium alloy is used in fast breeder reactors or solar power plants. In case of leakage of hot liquid metal concrete is loaded thermally and chemically. The interaction of sodium with several concretes of different composition has been investigated experimentally and theoretically. Especially the quartz content of concrete has a significant influence on reaction behavior. Quartz-containing concrete specimens were severely damaged at temperatures of more than 600°C. Computer code modelling shows good agreement with experiments.

33270 (IAEA-SMR—68/2, pp 527-562) **TMI-2 and reactor safety.** Kato, W.Y. (Department of Nuclear Energy, Brookhaven National Lab., Upton, NY (USA)). Jun 1982. NTIS (US Sales Only), PC A25/MF A01. Order Number TI84780440.

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In Operational physics of power reactors. Proceedings of the course on operational physics of power reactors including start up, testing and fuel management held at Trieste, 3-28 March 1980 during the winter college on nuclear physics and reactors jointly organized by the IAEA and the ICTP and held at the ICTP, Trieste, 22 January - 28 March 1980.

The accident on March 28, 1979 at the Three Mile Island Unit 2 (TMI-2) nuclear power station located near Harrisburg, Pennsylvania has had a major impact upon the design, construction, operation, regulation and safety research of nuclear power plants. It also has had an impact on utility and regulatory organizations. This paper presents a review of the TMI-2 accident scenario, its consequences and the conclusions of various investigating groups. An overview of the nuclear licensing process, computer codes used in safety analysis, safety research, and current issues is provided, using as a basis the TMI-2 accident. Some of the current safety issues which are included in the proposed NRC rulemaking hearings on such subjects as safety goals, siting criteria, emergency plans, and degraded or damaged core analysis are discussed.

33271 (INIS-BR—120, pp 206-207) **Determination of CTS-1 parameters in emergency cases.** Araujo, F.G.B. de; Cesar, S.B.G. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33272 (INIS-BR—120, pp 207) **Loop for tests with sodium fire - CTS-2.** Pinto, A.J.R.; Bispo, D.A.; Croza, G.I. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)) (and others). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33273 (INIS-BR—120, pp 208) **Program for pressure drop calculation in water loop.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33274 (INIS-BR—120, pp 223-224) **Computer code to simulate transients in a PWR power plant.** Alvim, A.C.M.; Botelho, D.A.; Sato, E.F.; Mello, L.A. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33275 (INIS-BR—120, pp 224) **Model for transient simulation in a PWR steam circuits.** Mello, L.A. de; Botelho, D.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33276 (INIS-BR—120, pp 224-225) **Simulation of the thermalhydraulic behavior of a PWR fuel rod during blowdown.** Gadelha, J.A.M.; Alvim, A.C.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33277 (INIS-BR—120, pp 214) **Study on the efforts produced by an incident of abrupt liberation of energy in PEC reactor.** Bezerra, L.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33278 (INIS-BR—120, pp 217) **Development of a computer code for transient simulation in fast reactors.** Botelho, D.A.; Alvim, A.C.M.; Santos, R. de S. dos; Gebrin, A.N. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33279 (INIS-BR—120, pp 217-218) **Transient simulation in a medium channel of LMFBR.** Santos, R. de S. dos (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33280 (INIS-BR—120, pp 218-222) **Digital simulation of transients in a sodium-sodium intermediary heat exchanger.** Gebrin, A.N. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

A computer program to simulate a sodium-sodium heat exchanger in normal and abnormal operation was developed. Two simplifications were used : rate of flow spatially uniform and shell and tube model. (E.G.).

33281 (INIS-BR—120, pp 233) **Safety of sodium storage and sodium extinction.** Goncalves, A.C.; Alleluia, I.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33282 (INIS-mf—8345) **GRS annual report 1982.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). 1982. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780326.

The report contains, among other things, the "Risk-Orientated Analysis for the SNR-300". Moreover, current work in the fields of projects, data processing, procedures (simulation, PKL experiment E 1), and systems (ergonomics) are described. The field of dynamics and radiation protection dealt with the aspects of disturbances and activity releases in heavy accidents of the SNR-300. In the field of operation recurrent tests in npps and studies in plant safety were made. The programme "Research on the Safety of LWR" was technically supervised together with the project. (DG).

33283 (INIS-mf—8747) **Evaluation and mitigation of accidental releases of radioactivity. Identification of uncertainties. Proceedings.** Bruessermann, K. (ed.). (Gesellschaft fuer Umweltueberwachung m.b.H., Aldenhoven (Germany, F.R.)). Dec 1982. 74p. (CONF-8104232—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780346.

From Workshop on evaluation and mitigation of accidental releases of radioactivity; Bad Muenstereifel, F.R. Germany (5 Apr 1981).

One result of the workshop was, that even in the case of severe accident sequences in modern nuclear power plants (other facilities were not discussed), there will be enough time to take active measures in order to lower the emissions and to diminish the consequences inside and outside of the plant. On the whole, new evidence from Harrisburg show that previously estimated accidental emissions, especially of radiologically relevant nuclides, have been rather conservative and that much lower emissions are possible, if the above measures are considered. Under accident conditions, models to predict radiation exposure must be applied under the event of a short-term release. (orig./DG).

33284 (INIS-mf—8930, pp 91-103) **Simulation of dynamics of pressurized water reactor power plant.** Mueller, V.; Sedlacek, J.; Zatloukal, J. (Skoda, Plzen (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780245. (CONF-8112102—Vol.3).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The mathematical and physical model is described used for the analysis of failures of pressurized water reactor units as is computer program SIMOD-1S. The computed variants are based on the nominal output level of power plant operation. The following failures are considered: a failure of the turbogenerator with simultaneous failure of the automatic control for opening the by-pass stations of steam to condenser, the simultaneous failure of the turbogenerator and a varying number of main circulating pumps, variants with deviations from the reference output of the turbogenerators, variants with change in reactivity. (H.S.).

33285 (INIS-mf—8930, pp 118-129) **LOCA analyses.** Brezina, V.; Sekyra, M. (Energoprojekt, Prague (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780245. (CONF-8112102—Vol.3).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The problem is discussed of the investigation of loss-of-coolant accidents of the primary circuit of a nuclear power plant. Currently the EGP uses a derivative of the RELAP-3 program known as RELAP-EGP, and program RELAP MK4 which is the British version of RELAP 4, somewhere between MOD005 and MOD006, is being tested and put into operation. A brief description is presented of a physical model of the primary circuit and mathematical solutions are indicated. For demonstrating the course of the computations the time courses are analyzed of the throughflow between the reactor core and the upper mixing chamber of the reactor and between the outlet from the reactor and the point of connection of the pressurizer to the hot branch of the primary circuit. Also discussed is the influence of the composition of the model circuit on the results and possible errors. (B.S.).

33286 (INIS-mf—8930, pp 161-165) **Program TRANS for calculation of transients in light water reactor fuel assembly.** Juzova, Z. 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780245. (CONF-8112102—Vol.3).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The TRANS program is designed for solving transient processes which may occur in the fuel assembly of a light water reactor owing to disturbances in reactivity, output, pressure, input temperature or flow rate, pressure losses, etc. The program considers concentrated coolant parameters over the fuel assembly cross section and describes the one-dimensional coolant flow along a rod bundle. Also solved is the problem area of the thermodynamic imbalance between the water and steam phases, heat transfer from fuel to coolant and heat conduction in fuel. The program also solves the problem of safety in case of departure nucleate boiling. The problems related to changes in reactivity are solved using the point model of neutron kinetics. (J.B.).

33287 (INIS-mf—8930, pp 104-117) **Calculation of transients in WWER power plant.** Macek, J.; Kyncl, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780245. (CONF-8112102—Vol.3).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

A mathematical model is described for the computation of transient processes in a nuclear power plant as is the DYNAMIKA computer program. The program is used for computing two accident variants: rupture of the main steam collector and a failure of the main circulating pump. (H.S.).

33288 **(IS-M—475) Reliability of steel containments with internal pressure.** Greimann, L.; Fanous, F. (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 4p. (CONF-840160—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014128.

From EM/GT/ST specialty conference; Berkeley, CA, USA (1 Jan 1984).

Containment structures for nuclear power plants have long been designed for static internal pressure. However, since the Three Mile Island accident there has been heightened interest in the behavior of containments under conditions beyond design, particularly the actual, in-place resistance of containments to static internal pressure. Probabilistic methods are being applied to both the loading and resistance quantities so public risk can be accurately assessed. In this paper, a reliability assessment of a steel containment under uniform internal pressure will be summarized.

33289 **(IS-M—486) Uncertainties associated with containment analysis.** Greimann, L.; Fanous, F. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 18p. (CONF-840647—19). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013730.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

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The containment structure is designed to prevent leakage for a variety of environment and accident loading conditions. However, loadings more severe than the design loading can be postulated, such as an increasing pressure. Approaches to predicting the containment resistance to an internal pressure are summarized. Uncertainties associated with these approaches are also discussed. Containment failure criteria are not well established. However, most investigators agree that the containment has failed when leakage occurs, since it can no longer perform its intended service. Several criteria have been employed to express containment failure: the formation of a limit mechanism, strain or deformation limits and buckling. For concrete containments, additional criteria such as radial shear stresses, liner plate strain and reinforcement steel strain are often used as an indication of failure. Almost all containment analyses, to date, have been based upon an axisymmetric structural model of the containment shell. For this model, many nonsymmetric features must be neglected or accounted for in an approximate way. The degree of sophistication of the analyses techniques range from hand calculations to finite element methods. Another source of uncertainty in the prediction of containment strength is the material model. Uncertainties often exist in the data. The analytical description of reinforced concrete is one of the larger uncertainties in the analysis of concrete vessels. Aspects of the steel/concrete interface, i.e., bond, anchorage, are difficult to describe analytically. The cracking, bar yielding and aggregate interlocking problem remain yet unsolved. Soil and pressure modeling are another source of uncertainty.

33290 **(IS-M—489) Probabilistic seismic resistance of a Mark III steel containment.** Fanous, F.; Greimann, L. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 17p. (CONF-840647—21). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013727.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

Concern for the safety of nuclear power plants has motivated efforts to determine the statistical characteristics of the seismic resistance of steel containments. This paper represents a portion of a project whose objective is to assess the uncertainty of containment strength subjected to earthquakes (and other types of loading). The seismic response is predicted by a random vibration technique outlined in a paper previously published by the authors and calibrated to a design response spectrum. BOSOR4 is first used to predict linear vibration modes. Modal analysis methods are utilized, with the random vibration technique, to obtain a statistical description of the random process stress resultants for a unit g peak ground acceleration. Peak stress resultants are described by Extreme Value I. The mean peak values are input into BOSOR5 and the peak g-level is increased until failure (strain ductility of two) is reached. An approximate product failure function is obtained by perturbing the other random variables, namely, geometric imperfections, damping, and yield strength. The Advanced First Order Second Moment technique is then used to construct the cumulative distribution of the containment seismic resistance as a function of peak ground acceleration. The resulting distribution is given for a typical Mark III steel containment. Fragility curves for the containment at 95% and 5% certainty are also given.

33291 (IWGFR—43, pp 35-42) **Italian position paper on the safety analysis of liquid metal fast breeder reactors as related to sodium fires. The PEC reactor.** Gerosa, A. (Safety and Health Protection Directorate, ENEA, Rome (Italy)). Jan 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780439. (CONF-820590—Summ.).

From International working group on fast reactors specialists' meeting on sodium fires, design and testing; Richland, WA, USA (24 May 1982).

To obtain a deep understanding of physical phenomena and engineering problems connected with sodium fires, and to optimize the utilization of human and financial resources available, CNEN (now ENEA) has decided to join the French Commissariat a l'Energie Atomique (CEA) in the realization of a Franco-Italian experimental programme on sodium fires, named ESMERALDA. As for design preventions for PEC reactor (a fast flux, liquid metal cooled, fuel element testing reactor) fundamental choices were made taking into account all available knowledge, but with particular reference to the results of CEA's previous experiments on sodium fires. More detailed design analysis will be possible in the future, based on experimental results coming from the ESMERALDA programme.

33292 (IWGFR—43, pp 49-62) **Liquid metal fires. A review of work status in the United Kingdom.** Newman, R.N. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Vaughan, G.J. (National Nuclear Corp. Ltd., Risley (UK)); Hargreaves, K. (UKAEA, Risley). Jan 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780439. (CONF-820590—Summ.).

From International working group on fast reactors specialists' meeting on sodium fires, design and testing; Richland, WA, USA (24 May 1982).

These studies comprise investigations of the combustion mechanisms of sodium in both liquid and vapour states, and of the reactions of sodium with structural materials at high temperature. Extensive studies are also under way on the chemical and physical nature and on the behaviour of airborne reaction products released from fires. Data from these studies are used as an input to codes developed to model conditions resulting from sodium fires and thus to provide a basis for the design of containment structures and air clean-up equipment requirements. A knowledge of liquid metal combustion mechanisms is also a necessary adjunct to the development of fire prevention and fire-fighting systems. In the UK fire studies are conducted by CEGB (Berkeley Laboratories), NNC and the UKAEA, and this paper reviews the status of work carried out.

33293 (IWGFR—43, pp 63-70) **United States position paper on sodium fires, design and testing.** Hilliard, R.K. (Hanford Engineering Development Lab., Richland, WA (USA)); Johnson, R.P. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group); Powers, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780439. (CONF-820590—Summ.).

From International working group on fast reactors specialists' meeting on sodium fires, design and testing; Richland, WA, USA (24 May 1982).

The first Specialists' Meeting on sodium fire technology sponsored by the International Working Group on Fast Reactors (IWGFR) was held in Richland, Washington in 1972. The group concluded that the state-of-technology at that time was inadequate to support the growing LMFBR industry. During the second IWGFR Specialists' Meeting on sodium fires, held in Cadarache, France in 1978, a large quantity of technical information was exchanged and areas were identified where additional work was needed. Advances in several important areas of sodium fire technology have been made in the United States since that time, including improved computer codes, design of a sodium fire protection

system for the CRBRP, measurement of water release from heated concrete, and testing and modeling of the sodium-concrete reaction. Research in the U.S. related to sodium fire technology is performed chiefly at the Energy Systems Group of Rockwell International (including Atomics International), the Hanford Engineering Development Laboratory, and the Sandia National Laboratories. The work at the first two laboratories is sponsored by the U.S. Department of Energy, while that at the latter is sponsored by the U.S. Nuclear Regulatory Commission. Various aspects of sodium fire related work is also performed at several other laboratories. The current status of sodium fire technology in the U.S. is summarized in this report.

33294 **(KFK—3560) Direct measurement of aerosol shape factors.** Zeller, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik I; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1983. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751451.

The dynamic shape factor whereas the coagulation shape factor is an average over the total examined size range. The experiments have shown that the results of experiments with a certain aerosol system cannot be transferred to other aerosol systems without further consideration. The outer shape of particles of a certain size depends on the specific properties of the material as well as on the experimental conditions during the aerosol generation. For both aerosol systems examined the mean dynamic shape factor, averaged over the total examined size range, agrees roughly with the coagulation shape factor. (Description of aerosol centrifuge and of differential mobility analyzer).

33295 **(LA-UR—83-3658) TRAC-PF1 analysis of loss-of-fluid test L6-7/L9-2.** Meier, J.K. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-840813—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84004415.

From Design, construction and operation of nuclear power plants conference; Portland, OR, USA (5 Aug 1984).

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The Los Alamos National Laboratory is developing the Transient Reactor Analysis Code (TRAC-PF1) to provide the capability for advanced best-estimate predictions of postulated accidents in pressurized-water reactors (PWRs) and for many thermal-hydraulic experimental facilities. As part of an independent assessment of TRAC-PF1, Loss-of-Fluid Test (LOFT) L6-7/L9-2 is analyzed and compared to the calculated results. Test L6-7 simulated a cooldown transient similar to the Arkansas Nuclear One Unit-2 turbine-trip transient. During the L9-2 phase of the test, the primary-coolant pumps were tripped and natural circulation cooled the core while the plant cooldown continued. The TRAC results matched the test data well during the L6-7 portion of the transient (0.0-324 s). However, during the L9-2 portion the calculated natural-circulation flow rate in the intact loop was much higher than the measured rate.

33296 **(LA-UR—84-1586) Numerical fluid dynamics calculations of nonequilibrium steam-water flows with entrained droplets.** Williams, K.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 38p. (CONF-8404146—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012439.

From International workshop on fundamental aspects of post-dryout heat transfer; Salt Lake City, UT, USA (2 Apr 1984).

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The present work has developed a computational fluid dynamics formulation that efficiently solves the conservation laws for a vapor field, a continuous liquid field, and two dispersed droplet fields. The thermal-hydraulic effects resulting from the exchange of mass, momentum and energy between the vapor and the dispersed droplet phases has been accurately modeled. This work is an advancement of the state-of-the-art for engineering analyses of nonequilibrium steam-water-droplet flows in heated channels. It is particularly applicable for boiling steam-water flows in which it is important to represent the effects of significant thermal nonequilibrium between the vapor and the liquid phases. This work was shown to be in good agreement with unique experimental measurements of significant thermal nonequilibrium between the vapor and dispersed droplets. The tests analyzed covered a range of mass fluxes and wall heating rates, and were all at low pressures where nonequilibrium effects are most pronounced.

33297 **(LA-UR—84-1721) Fast numerical methods in 3-D.** Woodruff, S.B. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 11p. (CONF-8405188—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012585.

From Engineering faculty meeting; Los Alamos, NM, USA (30 May 1984).

During the past decade, various semi-implicit finite-difference schemes such as that used in version PD2 of the Transient Reactor Analysis Code (TRAC-PD2) have been applied to problems in fluid flow. The stability-enhancing two-step (SETS) method was created to improve the running time of the existing TRAC code with inimal impact on the code structure and results. The SETS method eliminates the material Courant stability limit simply by adding a stabilizer step to the basic semi-implicit equations. The SETS method has been extended successfully to equations for three-dimensional, two-phase flow and the demonstration computer code used for this extension has been written in a form that can be adapted by other researchers. The method currently is being incorporated into our reactor safety systems code to provide the numerical foundation for a multidimensional code that can run faster than real time.

33298 **(NUREG—0090-Vol.6-No.4) Report to Congress on abnormal occurrences, October-December 1983. Vol. 6, No. 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). May 1984. 30p. NTIS, PC A03/MF A01 - GPO*. Order Number DE84901383.

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Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from October 1 to December 31, 1983. The report states that for this report period, there was one abnormal occurrence at the nuclear power plants licensed by the NRC to operate. The item involved generic problems pertaining to a specific manufacturer's emergency diesel generators. There was one abnormal occurrence for the other NRC licensees. The item involved an overexposure of a radiographer. There was one abnormal occurrence reported by an Agreement State. The item involved an overexposure to a radiographer. The report also contains information updating some previously reported abnormal occurrences.

33299 **(NUREG—0776-Suppl.7) Safety evaluation report related to the operation of Susquehanna Steam Electric Station, Units 1 and 2 (Docket Nos. 50-387 and 50-388). Suppl. 7.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). May 1984. 19p. NTIS, PC A02/MF A01 - GPO* $3.00. Order Number DE84901262.

In April 1981, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-0776) regarding the application of the Pennsylvania Power and Light Company (the applicant and/or licensee) and the Allegheny Electric Cooperative, Inc. (co-applicant) for licenses to operate the Susquehanna Steam Electric Station, Units 1 and 2, located on a site in Luzerne County, Pennsylvania. This supplement to NUREG-0776 addresses those issues which required resolution prior to allowing Unit 2 operation at power levels exceeding 5% rated power.

33300 **(NUREG—0853-Suppl.3) Safety evaluation report related to the operation of Clinton Power Station, Unit No. 1 (Docket No. 50-461). Suppl. 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). May 1984. 41p. NTIS, PC A03/MF AO1 - GPO* $4.00. Order Number DE84901263.

Supplement No. 3 to the Safety Evaluation Report on the application filed by Illinois Power Company, Soyland Power Cooperative, Inc., and Western Illinois Power Cooperative, Inc., as applicants and owners, for a license to operate the Clinton Power Station, Unit No. 1, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is located in Harp Township, DeWitt County, Illinois. This supplement reports the status of certain items that had not been resolved at the time of publication of the Safety Evaluation Report and Supplements No. 1 and 2.

33301 (NUREG—1062) **Dose calculations for severe LWR accident scenarios.** Margulies, T.S.; Martin, J.A. Jr. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). May 1984. 222p. NTIS, PC A10/MF A01 - GPO* $6.50. Order Number DE84901375.

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This report presents a set of precalculated doses based on a set of postulated accident releases and intended for use in emergency planning and emergency response. Doses were calculated for the PWR (Pressurized Water Reactor) accident categories of the Reactor Safety Study (WASH-1400) using the CRAC (Calculations of Reactor Accident Consequences) code. Whole body and thyroid doses are presented for a selected set of weather cases. For each weather case these calculations were performed for various times and distances including three different dose pathways - cloud (plume) shine, ground shine and inhalation. During an emergency this information can be useful since it is immediately available for projecting offsite radiological doses based on reactor accident sequence information in the absence of plant measurements of emission rates (source terms). It can be used for emergency drill scenario development as well.

33302 (NUREG/BR—0051-Vol.5-No.6) **Power reactor events, November-December 1983. Volume 5, No. 6.** Massaro, S.A. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). May 1984. 48p. NTIS, PC A03/MF A01 - GPO*. Order Number DE84901373.

This is a bi-monthly newsletter that compiles operating experience information about commercial nuclear power plants. This includes summaries of noteworthy events and listings and/or abstracts of USNRC and other documents that discuss safety-related or possible generic issues. It is intended to feed back some of the lessons learned from operational experience to the various plant personnel.

33303 (NUREG/CP—0048-Vol.5) **Eleventh water reactor safety research information meeting. Volume 5.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1984. 351p. (CONF-8310143—Vol.5). NTIS MF A01 - GPO* $8.00. Order Number DE84900649.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Separate abstracts were prepared for papers presented in the following areas: (1) Mechanical Engineering; (2) Structural Engineering; (3) Seismic Research Program; (4) Instrumentation and Control Program; and (5) Research on Equipment Survival in Accidents.

33304 (NUREG/CP—0048-Vol.5, pp 1-25) **Overview of pipe breaks from the perspective of operating experience.** Bush, S.H. 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The purpose of this paper is to give a semi-quantitative overview of pipe cracking. The dearth of information in many light water reactors (LWR's) does not permit quantification other than in certain systems, or where failure occurred by specific mechanisms. Usually, in these cases the manufacturer provided the information. Pipe cracking incidents in pipe sizes below 4 inches have been limited to brief comparisons. Causal mechanisms are tabulated for both BWRs and PWRs. The numbers should be examined in terms of trends not absolutes. IGSCC is a major contributor to BWRs; is significance to PWRs is usually limited to thin-walled austenitics. The incidence of thermal fatigue is quite high in PWRs. Most other failures tend to be random with the possible exception of erosion-cavitation. These failure mechanisms are discussed in more detail in this paper.

33305 (NUREG/CP—0048-Vol.5, pp 26-32) **Elimination of the double-ended guillotine break in primary pipe loops.** Chou, C.K. (Lawrence Livermore National Lab., CA). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Load Combination Program at the Lawrence Livermore National Laboratory is currently conducting a probabilistic assessment of the primary coolant piping of all operating nuclear power plants, as well as those under construction. The goal of this assessment is to determine the necessity for including the double-ended guillotine break (DEGB) of primary coolant loops as a design basis load for nuclear power plant design. The DEGB design basis load has been an important loading element greatly affecting many nuclear power plant facility designs either directly or indirectly. The DEGB load also influences plant construction costs and safety margins. This paper is divided into five sections: (1) cost and safety assessments associated with the implementation of DEGB design requirements; (2) LLNL's technical approach in assessing the probability of occurrence of a DEGB design basis event; (3) technical evaluation results; (4) general discussion and conclusions; and (5) related subjects.

33306 (NUREG/CP—0048-Vol.5, pp 33-35) **View of industry on the impact of pipe break criteria.** Bernsen, S.A. 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Historically, large pipe breaks in the types of materials used and under operating conditions similar to those in light water reactor service have not occurred. Nevertheless, the non-mechanistic assumption of a double ended pipe break of the early sixties, selected for loss of coolant accident analysis purposes, has become a mechanistic criterion for the design and arrangement of high pressure piping systems and their associated supports and enclosures in today's nuclear plants. While it seems reasonable and appropriate to continue to design the Emergency Core Cooling Systems for a range of loss of coolant accidents up to and including those that approximate the area of the largest pipe connected to the reactor vessel and to use this break in determining the loading and temperature rise rate for containment structures and equipment qualification, it no longer seems reasonable to provide precisely engineered break protection for a limited number of potential pipe break locations. This observation is gaining increasing support, particularly as engineering judgment and historical perspectives are being supplemented by both deterministic and probabilistic studies that indicate the potential for large instantaneous breaks in nuclear grade piping systems is virtually incredible. Fracture mechanics analyses support leak-before-break assumptions with wide margins and probabilistic studies indicate potentials for double-ended pipe breaks in the range of less than one in a billion years.

33307 (NUREG/CP—0048-Vol.5, pp 36-45) **Pipe-to-pipe impact tests.** Bampton, M.C.C.; Alzheimer, J.M.; Simonen, F.A.; Friley, J.R. (Pacific Northwest Lab., Richland, WA). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The objective of the program is to generate experimental data and supporting analyses to evaluate the Nuclear Regulatory Commission's criteria for anticipated damage due to pipe whip. These criteria are contained in the Standard Review Plan 3.6.2 and are stated as follows: An unrestrained whipping pipe should be considered capable of causing circumferential and longitudinal breaks, individually, in impacted pipes of smaller nominal pipe size, and de-

veloping through-wall cracks in equal or larger nominal pipe sizes with thinner wall thickness, except where analytical or experimental, or both, data for the expected range of impact energies demonstrates the capability to withstand the impact without rupture. The set of required data points will be achieved by a sequence of tests and analyses. Analysis methods will be applied to predict the damage to be experienced by a given pipe configuration when impacted by another pipe of a specific configuration and impact velocity. The results of the analyses will be used to select conditions for each test and subsequently the results of each test will be used to establish the accuracy of the analysis methods. Thus, an iteration process will establish the appropriate relations between pipe damage and available impact energy.

33308 (NUREG/CP—0048-Vol.5, pp 46-61) **Scale modeling of reinforced concrete structures subjected to seismic loading.** Dove, R.C. (Los Alamos National Lab., NM). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Reinforced concrete, Category I structures are so large that the possibility of seismicly testing the prototype structures under controlled conditions is essentially nonexistent. However, experimental data, from which important structural properties can be determined and existing and new methods of seismic analysis benchmarked, are badly needed. As a result, seismic experiments on scaled models are of considerable interest. In this paper, the scaling laws are developed in some detail so that assumptions and choices based on judgement can be clearly recognized and their effects discussed. The scaling laws developed are then used to design a reinforced concrete model of a Category I structure. Finally, how scaling is effected by various types of damping (viscous, structural, and Coulomb) is discussed.

33309 (NUREG/CP—0048-Vol.5, pp 62-96) **Uses of an earthquake simulator.** Sozen, M.A. (Univ. of Illinois, Urbana). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Earthquake simulation in the laboratory may be defined as the process of moving, at prescribed varying rates of speed, the base of a test structure through a displacement program representing one or several components of a particular earthquake motion. The energy and control requirements for such an undertaking tend to limit the size of the test structure and the number of base motion components in a given test. This restraint leads to a series of compromises which reduce the test structure, not necessarily in size, to a model with all the attendant doubts about its relevance to the real thing. The simulator may be used in two modes: (1) to test a prototype, which may be a small building or a building unit, and (2) to test a theoretical concept represented by a physical model. An example of an actual modelling process is discussed; described are the steps involved in experimental analysis of conditions leading to the failure of a particular building.

33310 (NUREG/CP—0048-Vol.5, pp 97-121) **Design and analysis of concrete structures.** Ucciferro, J.J. 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

This paper presents an overview of the design and analysis of nuclear concrete structures subjected to postulated extreme loads. Although other loadings are addressed, the primary emphasis is on seismic. Both an auxiliary building and a containment building are included in the overview. The latter portion of the paper addresses specific requirements which have produced difficulty as viewed from the perspective of the designer/constructor. Since these requirements appear to be conservative, it is recommended that each identified requirement of the code or regulation be reviewed or additional research be performed.

33311 (NUREG/CP—0048-Vol.5, pp 122-138) **Seismic safety margins research program: an overview.** Bohn, M.P.; Shieh, L.C.; Wells, J.E.; Cover, L.E.; Bernreuter, D.L.; Johnson, J.J. (Lawrence Livermore National Lab., CA; Structural Mechanics Associates, San Ramon, CA). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

To assist the NRC in its licensing and evaluation role, the NRC funded the Seismic Safety Margins Research Program (SSMRP) at LLNL with the goal of developing tools and data bases to evaluate the risk of earthquake-caused radioactive release from a commercial nuclear power plant. This program began late in 1978, and the methodology was finalized in 1982. A complete seismic risk assessment for the Zion plant was finished in May 1983. This paper describes the SSMRP risk assessment methodology and the results of the Zion seismic probabilistic risk assessment.

33312 (NUREG/CP—0048-Vol.5, pp 139-145) **Multiple independent pipe support motions.** Bezler, P.; Subudhi, M.; Wang, Y.K.; Shteyngart, S.; Alforque, R. (Brookhaven National Lab., Upton, NY). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Efforts under the Mechanical Piping Benchmarks Program have continued through FY 83. Major work areas during this period were the investigation of multiple independent support motion (ISM) analysis methods and the confirmation of analysis methods by the consideration of and comparison to piping test results (physical benchmarks). In the study of ISM analysis methods, response predictions based on ISM response spectrum methods and alternate seismic anchor movement (SAM) analysis methods are compared to ISM time history results for various nuclear power plant piping configurations. Two physical benchmark confirmatory evaluations, the Indian Point Rigid Strut configuration and the Extended Z Bend ANCO test T6R1R, were completed. The former involved the analytical simulation of a snap back test of a feedwater line in the Indian Point Nuclear Power Plant Unit 1. The latter involved the blind prediction of the response of a simple pipe configuration seismically excited by three pipe mounted actuators. The correspondence of results achieved for the snap back test were only fair. The correspondence of results for the Z bend, as assessed by an alternate NRC contractor, were good. The physical benchmarking is being extended to the evaluation of larger and branched systems subjected to multiple independent excitations in a cooperative program between NRC, EPRI and ANCO Engineers, Inc.

33313 (NUREG/CP—0048-Vol.5, pp 146-174) **Engineering characterization of earthquake ground motion for nuclear power plant design.** Kennedy, R.P.; Short, S.A.; Idriss, I.M.; Power, M.S.; Costello, J.F. 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The basic question considered herein is what free-field ground motion characteristics should be the basis for the design response spectra of nuclear power plants. An observation which has been made by a number of people is that neither instrumental peak acceleration nor the elastic response spectra are good measures of potential seismic damage. The objective of this work is to develop recommendations for methods to be used in selecting design response spectra or time histories to be used to characterize motion at the foundation level of nuclear power plants. The problem of selecting design motions can be divided into two broad parts. The first part consists of choosing translational design criteria based on free-field motions with consideration of the response and performance of nuclear plant structures. The second part consists of choosing translational and rotational design criteria at structure foundation levels with additional considerations given to spatial variations of ground motions with soil-structure interaction. This paper covers the results of Phase I addressing the first part of the problem. Phase II addressing the second part of the problem is currently being performed.

33314 (NUREG/CP—0048-Vol.5, pp 189-205) **Dynamic tests of three-dimensional piping systems: a NRC/EPRI joint test program.** Tang, Y.K.; Tang, H.T. (Electric Power Research Inst., Palo Alto, CA). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The US Nuclear Regulatory Commission and the Electric Power Research Institute have jointly sponsored a piping research project. The intent of this research effort, which involves design, analysis, fabrication, erection, and dynamic testing of two three-dimensional piping systems, is to provide the following benefits: (1) to expand the limited controlled data base on damping in piping systems at response levels at and above operating basis earthquake (OBE) stress levels; (2) to stimulate recognition of safety margins implicit in ASME code rules for class 2/3 piping by demonstrating the existence of large design margins in piping and support systems when subject to seimsic load far beyond its SSE design stress limit; and (3) to obtain a data base for benchmarking computer methods for analysis of pressurized piping systems with representative support systems and for response levels below and above piping yielding as well as including pipe support failure. In-depth study of the first of two planned test configurations is underway. The tests include: (1) a six-inch diameter main with no branch lines, and (2) a six-inch diameter main with three-inch branch lines.

33315 (NUREG/CP—0048-Vol.5, pp 206-208) **Potential overdesign for the extreme load condition: current Pressure Vessel Research Committee Technical Committee on Piping Systems activities.** Landers, D.F. 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

A major concern of some members of the industry has been the increased rigidity of piping systems resulting from seismic and other dynamic load requirements and the response of the designer to those requirements. Note that the concern is two-fold: (1) requirements and (2) industry response. After years of concern being voiced and the presentation of papers and reports in the public forum the industry formed a special committee under the auspices of the Pressure Vessel Research Committee. This is not to say that substantial activities were not underway or completed by other investigators and organizations because they were. What was needed was an organization to review all the completed and ongoing activities as well as determine those areas which were most susceptible to modification. The Steering Committee on Piping Systems was organized and proceeded to appoint a Technical Committee on Piping Systems (the Committee) to perform the technical review of current data requirements, Codes, Regulations, etc., and make recommendations for modifications. The Steering Committee is an oversight group as well as having significant potential for making changes occur in the appropriate Codes or Regulations. The Committee is currently looking at four major areas: (1) damping values; (2) spectra; (3) dynamic stress criteria; and (4) industry practice.

33316 (NUREG/CP—0048-Vol.5, pp 209-225) **Safety implications of control systems.** Smith, O.L. (Oak Ridge National Lab., TN). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Safety Implications of Control Systems (SIOC) Program has three interrelated objectives: (1) to investigate failure modes and effects in non-safety control systems, including single failures and common cause, common mode, cascade, and other credible multiple failures, (2) to assess the impact upon safety of control system designs and their dynamic behavior, using methods that include computer modeling and analysis of system dynamics under stress, and (3) to develop criteria for determining the relative importance of control system influences upon safety, and with these as a basis to recommend design and operational standards for the systems involved. In support of these goals, the SIOC Program consists of three principal activities: (1) an augmented failure mode and effects analysis (FMEA) of the overall plant; (2) specific analysis of the plant electrical system; and (3) a hybrid computer model to augment the FMEA. This paper will discuss the status of each of these activities.

33317 (NUREG/CP—0048-Vol.5, pp 242-254) **Torsional ultrasonic technique for reactor vessel liquid level measurement.** Dress, W.B. (Oak Ridge National Lab., TN). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5). Contract W-7405-ENG-26.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

A liquid-level sensor based on the ultrasonic technique is a promising long-term solution for monitoring core cooling. An instrument based on the technique can display temperature and density profiles of high resolution along a chosen path through the reactor. The density data can be used to indicate voids (boiling), froth, and actual level as well as collapsed level. Correlation of these parameters with the outputs of other plant sensors provide desired event independence. The continuous nature of the temperature, level, and density information is another advantage of the ultrasonic method over those indicating at a limited number of discrete points. Compatibility with current reactor designs and the ability to perform under both normal and accident conditions is realized by the simple, all metal construction of the sensor, and by isolation of the transducer from the reactor core area.

33318 (NUREG/CP—0048-Vol.5, pp 255-260) **Non-invasive water level measurements at LOFT using a neutron detection system.** Baratta, A.; Jester, W.; Okyere, E.; Gundy, M.; Imel, G.; Kibler, M. (Pennsylvania State Univ., University Park). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Since the TMI-2 accident, the authors have worked on a concept for a non-invasive liquid level and density gauge. The system under study operates by detecting fast neutrons leaking from the pressure vessel. The intensity of such neutrons has been found to be extremely sensitive to changes in both coolant density and liquid level. Experimental research has been conducted both at the Pennsylvania State University's (PSU) Breazeale Nuclear Reactor (BNR) and at the Loss of Fluid Test Facility (LOFT) at the Idaho National Laboratory. The work to date has demonstrated the feasibility of this concept. This concept resulted from the authors study of the output of the TMI-2 source range detector (SRD) obtained during the accident and the analysis of the core conditions which produce this SRD output as determined by the Nuclear Safety Analysis Center (NSAC).

33319 (NUREG/CP—0048-Vol.5, pp 283-297) **Progress on qualification testing methodology study of electric cables.** Yoshida, K.; Seguchi, T.; Okada, S.; Ito, M.; Kusama, Y.; Yagi, T.; Yoshikawa, M. (Takasaki Radiation Chemistry Research Establishment, Japan). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Many instrumental, control and power cables are installed in nuclear power plants, and these cables contain a large amount of organic polymers as insulating and jacketing materials. They are exposed to radiation at high dose rate, steam at high temperature and chemical (or water) spray simultaneously when a LOCA occurs. Under such conditions, the polymers tend to lose their original properties. For reactor safety, the cables should be functional even if they are subjected to a loss-of-coolant accident (LOCA) at the end of their intended service life. In Japan, cable manufacturers qualify their cables according to the proposed test standard issued from IEEJ in 1982, but the standard still has many unsolved problems or uncertainties which have been dealt with tentatively through the manufacturer-user's agreement. The objectives of this research are to study the methodologies for qualification testing of electric wires and cables, and to provide the improved technical bases for modification of the standard. Research activities are divided into the Accident (LOCA) Testing Methodology and the Accelerated Aging Methodology.

33320 (NUREG/CP—0048-Vol.5, pp 298-315) **Survey of equipment qualification research activities with respect to LOCA environments.** Bonzon, L.L.; Bustard, L.D. (Sandia National Labs., Albuquerque, NM). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The intent of the full paper is to set the historical perspective for, and the current status of, the international activities involving safety-related equipment qualification (EQ) research efforts.

33321 (NUREG/CP—0048-Vol.5, pp 324-331) **Relationship of fire protection research to plant safety.** Berry, D.L. (Sandia National Labs., Albuquerque, NM). 1983. NTIS MF A01 - GPO* $8.00. Order Number TI84900649. (CONF-8310143—Vol.5).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

On the basis of fire research completed to date, current fire protection research activities by Sandia National Laboratories and the NRC are focused on the following topics: (1) spatial separation; (2) equipment damageability; (3) cabinet fires; and (4) probabilistic analyses. As discussed in this paper, a number of real-world power plant safety concerns have prompted the need for research to address these topics. Plans call for the use of a combination of analytical and experimental research, with the aim of resolving fire protection uncertainties or, at least, determining the magnitude of the uncertainties. Unanswered issues include: (1) the potential for fire damage (corrosive products, suppression) outside of the room in which a fire is occurring; (2) the safety significance of spurious suppression system actuation as a result of random or nonfire induced circumstances; and (3) the acceptability of using active fire control measures in the absence of purely passive protection schemes.

33322 (NUREG/CR—3310) **Testing of the CONTAIN code.** Sciacca, F.W.; Bergeron, K.D.; Murata, K.K.; Rexroth, P.E. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 397p. (SAND—83-1149). NTIS, PC A17/MF A01; 1 - GPO; GPO Dep. Order Number DE84013500.

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CONTAIN is a large computer code intended for use in the analysis of severe nuclear power plant accidents. Many tests have been conducted on CONTAIN to assess its adequacy for dealing with nuclear-accident problems. This report describes the CONTAIN test program and summarizes the results obtained to date. These results are presented so that users may be aware of the features of CONTAIN that have been checked and of the areas where problems have been identified. In addition, this report provides information needed by users to repeat tests of interest in their specific work areas. The test efforts have identified a substantial number of problems in the coding or logic of the CONTAIN code. Most of these problems have been corrected. These corrections have been included in the most recent versions of the code. CONTAIN can accurately treat most of the phenomena expected to occur in containment atmospheres. Some problems identified by the test program, involving pool-related phenomena, have prompted the development of a substantially new system of models for pool phenomena. When completed, this new system will be subjected to intense testing of the type described here.

33323 (NUREG/CR—3366) **High temperature melt attack on steel and urania-coated steel.** Powers, D.A.; Arellano, F.E. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 97p. (SAND—83-1350). NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84013532.

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A series of twelve experiments in which high-temperature melts streamed onto steel plates are described. Melts weighing 3 to 5 kg were formed by metallothermic reaction and had the compositions 55 w/o Fe and 45 w/o Al_2O_3 or 54 w/o UO_2, 16 w/o ZrO_2 and 30 w/o stainless steel. Steel plates exposed to the melts were between 0.95 and 1.90 cm thick. Some plates were coated with plasma-sprayed urania to thicknesses up to 2 mm. Stream velocities were varied between 102 and 255 cm/s. Steel plates exposed to the direct action of the melts were readily penetrated. Typical penetration rates were about 1 cm/s. The rate of penetration increased with the velocity of the melt stream. Urania coatings 0.23 and 1.0 mm thick inhibited penetration of the steel. Coatings 2 mm thick prevented penetration of plates exposed to melt for about 5 seconds. Data obtained in these tests and previous tests were used to form a correlation of the time required to penetrate a steel plate of thickness d in terms of melt temperature and melt velocity.

33324 (NUREG/CR—3566) **Socioeconomic consequences of nuclear reactor accidents.** Tawil, J.J.; Callaway, J.W.; Coles, B.L.; Cronin, F.J.; Currie, J.W.; Imhoff, K.L.; Lewis, P.M.; Nesse, R.J.; Strenge, D.L. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 196p. (PNL—4911). NTIS, PC A09/MF A01; 1 - GPO $6.00; GPO Dep. Order Number DE84013356.

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This report identifies and characterizes the off-site socioeconomic consequences that would likely result from a severe radiological accident at a nuclear power plant. The types of impacts that are addressed include economic impacts, health impacts, social/psychological impacts and institutional impacts. These impacts are identified for each of several phases of a reactor accident - from the warning phase through the post-resettlement phase. The relative importance of the impact during each accident phase and the degree to which the impact can be predicted are indicated. The report also examines the methods that are currently used for assessing nuclear reactor accidents, including development of accident scenarios and the estimating of socioeconomic accident consequences with various models. Finally, a critical evaluation is made regarding the use of impact analyses in estimating the contribution of socioeconomic consequences to nuclear accident reactor accident risk. 116 references, 7 figures, 15 tables.

33325 (NUREG/CR—3588) **Effect of LOCA simulation procedures on cross-linked polyolefin cable's performance.** Bustard, L.D. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 99p. (SAND—83-2406). NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84013527.

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Electrical and mechanical properties of three commercial cross-linked polyolefin (XLPO) materials, typically used as electrical cable insulation, have been monitored during these simulations of nuclear power plant aging and accident stresses. For one XLPO cable accelerated thermal aging is performed, then the samples are irradiated to the combined aging and LOCA total dose. Finally, a steam exposure is applied. For a second and third set of XLPO cables simultaneous applications of elevated temperature and radiation stresses are used to preaccident age specimens. These aging exposures are followed by simultaneous and steam exposures to simulate a LOCA environment. The measurement parameters during these tests included: dc insulation resistance, ac leakage current, ultimate tensile strength, ultimate tensile elongation, percentage dimensional changes, and percentage moisture absorption. Test results for three XLPO materials are presented.

33326 (NUREG/CR—3618) **OCA-P, a deterministic and probabilistic fracture-mechanics code for application to pressure vessels.** Cheverton, R.D.; Ball, D.G. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 94p. (ORNL—5991). NTIS, PC A05/MF A01 - GPO; GPO Dep. Order Number DE84013064.

The OCA-P code is a probabilistic fracture-mechanics code that was prepared specifically for evaluating the integrity of pressurized-water reactor vessels when subjected to overcooling-accident loading conditions. The code has two-dimensional- and some three-dimensional-flaw capability; it is based on linear-elastic fracture mechanics; and it can treat cladding as a discrete region. Both deterministic and probabilistic analyses can be performed. For the former analysis, it is possible to conduct a search for critical values of the fluence and the nil-ductility reference temperature corresponding to incipient initiation of the initial flaw. The probabilistic portion of OCA-P is based on Monte Carlo techniques, and simulated parameters include fluence, flaw depth, fracture toughness, nil-ductility reference temperature, and concentrations of copper,

nickel, and phosphorous. Plotting capabilities include the construction of critical-crack-depth diagrams (deterministic analysis) and various histograms (probabilistic analysis).

33327 (NUREG/CR—3704) Three-dimensional calculations of transient fluid-thermal mixing in the downcomer of the Calvert Cliffs-1 plant using SOLA-PTS. Daly, B.J. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 87p. (LA—10039-MS). NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84013530.

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The SOLA-PTS code has been used to analyze transient fluid-thermal mixing in a 180° sector of the downcomer and a cold leg of the Calvert Cliffs-1 plant for three assumed accident scenarios. The inlet boundary conditions for these calculations were obtained from mass flow rates and temperatures that were computed in systems code studies. The results of the three-dimensional SOLA-PTS calculations indicated that a pressurized thermal shock risk was mitigated for these accident scenarios as the result of the particular circulation patterns that developed in the downcomer.

33328 (NUREG/CR—3781-Draft) PCI-related cladding failures during off-normal events - draft. Van Houten, R.; Tokar, M.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1984. Contract AC07-76ID01570. 113p. (EGG—2313-Draft). NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. Order Number DE84013534.

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Pellet-cladding interaction (PCI) has long been identified as a fuel rod failure mechanism during power increases in both pressurized and boiling water reactors, and commercial guidelines have practically eliminated such failures during standard operations. A question remains regarding the possible formation of through-wall cladding cracks during several types of postulated off-normal reactor events involving power increases. This report includes preliminary findings for reactor events of the type addressed by Chapter 15 of the NRC Standard Review Plan. Specifically, the BWR turbine trip without bypass, PWR control rod withdrawal error, subcritical PWR control rod withdrawal error, BWR control blade withdrawal error, and the PWR steamline break are analyzed on the joint bases of peak rod power, power increase, ramp rate, and duration at elevated power. These Chapter 15 events are compared to numerous test reactor results and to other relevant investigations, and tentative conclusions on transient severity and data base adequacy are presented. Progress in developing computer codes for predicting PCI-induced fuel rod failures is also discussed. 49 references.

33329 (PB—84-169754) Development and quarter core PWR rod ejection accident application of the TITAN code. Final report 1982-83. Tsai, C.K.; Griggs, D.P.; Kazimi, M.S.; Henry, A.F. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1983. 137p. (MIT/EL—83-007). NTIS, PC A07/MF A01.

Sponsored in part by Long Island Lighting Co., Mineola, NY., Northeast Utilities Service Co., Hartford, CT., and Yankee Atomic Electric Co., Westboro, MA.

New features have been added to TITAN, which is an advanced 3-D thermohydraulic and neutronic coupled code. The new features include a high order feedback model, a xenon model and a capability to handle nonreactangular (zig-zag) geometry. A central rod ejection accident of a typical 3-loop PWR within 0.1 seconds, was simulated with a quarter-core model, comprising 47 assemblies. The results seem reasonable, although different from MEKIN-B results, reported by BNL. The steady state solutions with and without cross-flow were found to have no significant differences. The calculational speed on the Honeywell Multics machine was roughly .4 cpu seconds (about 1500 cpu seconds on IBM 370/160) for convergence. The transient results show power peaking after 0.12 seconds at about 1.50 the initial power, as opposed to the results predicted by MEKIN-B of a factor of 2.0 rise in power. A user's guide is given as an Appendix to the report.

33330 (PB—84-186931) Seabrook Station probabilistic safety assessment. Summary report. (Pickard-Lowe and Garrick, Inc., Irvine, CA (USA)). Dec 1983. 30p. NTIS, PC A03/MF A01.

See also PB84-186949.; Sponsored in part by Public Service Co. of New Hampshire, Manchester and Yankee Atomic Electric Co., Framingham, MA.

This report documents an independent probabilistic safety assessment of the twin nuclear power plants under construction near Seabrook, New Hampshire. This assessment quantified the risk to public health and safety associated with potential accidents during the period of operation of the station. The project employed an advanced safety assessment discipline known as probabilistic risk assessment and included within its scope all known causes of potential accidents including human error, earthquakes, aircraft crashes, hurricanes, equipment malfunctions, and other causes of potential accidents. The study concluded that when the reactor units are put into operation, there will be a very small increase in both the individual and societal risks within the population surrounding the station. A full quantification of the effects of these uncertainties in the risk estimates has been provided. The most important results of the study are insights about the importance to safety of the design and operation of the plant, and insights about the effectiveneas of emergency plans.

33331 (PB—84-186949) Seabrook Station probabilistic safety assessment. Main report, volumes 1-6 and summary report. (Pickard-Lowe and Garrick, Inc., Irvine, CA (USA)). Dec 1983. 4512p. (PLG—0300). NTIS, MF E15.

Sponsored in part by Public Service Co. of New Hampshire, Manchester and Yankee Atomic Electric Co., Framingham, MA.

This report documents an independent probabilistic safety assessment of the twin nuclear power plants under construction near Seabrook, New Hampshire. This assessment quantified the risk to public health and safety associated with potential accidents during the period of operation of the station. The main report contains the technical analyses of the Seabrook plant and site, the risk modeling and data analysis.

33332 (SAND—83-2330C) Analysis of combustion in closed or vented rooms and vessels. Cummings, J.C.; Lee, J.H.S.; Camp, A.L.; Marx, K.D. (Sandia National Labs., Albuquerque, NM (USA); McGill Univ., Montreal, Quebec (Canada); Sandia National Labs., Livermore, CA (USA)). 1984. Contract AC04-76DP00789. 53p. (CONF-840828—1). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007343.

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

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It is well recognized that turbulence and acoustic instability play important roles in the pressure development in closed and vented explosions which may render the standard explosion venting guidelines invalid. In the future, more realistic estimates of venting requirements may be obtained through the use of computer models. The present paper reviews the analysis required to predict the pressure history within closed or vented rooms and vessels due to combustion. Computer codes with various levels of detail and sophistication are reviewed. As specific examples, we discuss the details of a simple lumped-parameter computer code called HECTR (which was developed to calculate the transient response - pressures, temperatures, and species concentrations - of a nuclear plant containment building to hydrogen combustion) and a two-dimensional, finite-difference computer code called CONCHAS-SPRAY (which solves the equations for transient, multicomponent, chemically reactive fluid dynamics). Several examples of HECTR and CONCHAS-SPRAY combustion calculations for experimental test vessels and nuclear reactor containment buildings are presented. Finally, we discuss the application of codes like HECTR and CONCHAS-SPRAY to complex situations that might occur during an accident at an industrial plant.

33333 (SAND—83-2393C) Demonstrations and verification of debris bed models in the MEDICI reactor cavity code. Trebilcock, W.R.; Bergeron, K.D.; Gorham-Bergeron, E.D. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 19p. (CONF-840816—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006104.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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The MEDICI reactor cavity model is under development at Sandia National Laboratories to provide a simple but realistic treatment of ex-vessel severe accident phenomena. Several demonstration cases have been run and are discussed as illustrations of the model's capabilities. Verification of the model with experiments has supplied confidence in the model.

33334 **(SAND—83-2654C) Effects on consequences of the high steam content in LWR accident releases: physics and preliminary results.** Spulak, R.G. Jr.; Boughton, B.A.; Williams, D.C.; Cummings, J.C.; Alpert, D.J.; Richards, C.N.; Dunn, W.E. (Sandia National Labs., Albuquerque, NM (USA); Atmospheric Physics, Inc., Peralta, NM (USA); Illinois Univ., Urbana (USA)). 1984. Contract AC04-76DP00789. 14p. (CONF-840701—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013060.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

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Our research has addressed the possibility that condensation of steam during the release of containment gases and aerosol particles to the atmosphere after a core-melt accident could deposit a significant fraction of the radioactive material near the plant. This paper describes the modeling of accident releases including this rainout and discusses the impact of our findings on risk predictions. Our models include details of the hydrodynamics of the flow from containment, thermodynamics of the release mixture, explicit consideration of condensation on the radioactive aerosols, turbulent agglomeration of aerosols and water droplets, buoyant plume physics, and the dispersion and deposition of drops. We discuss the initial and boundary conditions which lead to significant rainout.

33335 **(SAND—84-0368C) Capabilities of HECTR Version 1.0.** Dingman, S.E.; Camp, A.L.; Wester, M.J. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 22p. (CONF-840813—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006959.

From Design, construction and operation of nuclear power plants conference; Portland, OR, USA (5 Aug 1984).

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HECTR (Hydrogen Event: Containment Transient Response) is a computer code that has been developed at Sandia National Laboratories to predict the transient pressure and temperature responses in reactor containments during hypothetical accidents involving hydrogen combustion. The capabilities of HECTR Version 1.0 are described. Example calculations demonstrating the ability of HECTR to model PWR ice-condenser and BWR Mark III containments are presented, along with descriptions of the pertinent models.

33336 **(SAND—84-0722C) Containment release modes, rainout, and risk.** Spulak, R.G. Jr.; Boughton, B.A. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 14p. (CONF-8406124—6). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013055.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

Reactor containment failure due to overpressurization (from generation of steam and noncondensible gases or hydrogen burning) after a core-melt accident will result in the release of the contents of the containment atmosphere to the environment. This research has addressed the possibility that condensation of some of the steam outside the containment could lead to deposition of a significant fraction of the radioactive material near the plant. Three types of release from the containment are considered: a puff from a large-scale rupture, a jet from a discrete hole, and release from a crack or network of fissures or cracks. The physical details of the exit from the containment is different in each case, possibly leading to a different likelihood of condensation and rainout. Each of these releases has been modeled to the point where the material begins to mix with the ambient air. In addition, the jet release has been modeled from this point through entrainment of ambient air, condensation and agglomeration of water droplets, transition to a plume, and deposition of drops on the ground.

33337 **(SAND—84-0798C) Experimental and analytical results of steel containment tests.** Horschel, D.S. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 15p. (CONF-8406124—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012960.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

The Containment Integrity Division at Sandia National Laboratories is conducting tests on models of nuclear containment buildings. The tests currently being conducted are on steel containment vessels subjected to quasi-static internal overpressurization. Four 1/32 scale models have been tested by incrementally pressurizing the model until failure or leakage occurs. The testing of the containment models provides both insight and data on the response of containment vessels to overpressurization. The data are used to answer important technical questions that have arisen and to assess the adequacy of analytical methods in predicting containment behavior to accidents more severe than design basis accidents. Some of the details about the tests and the results of the experiments as well as the results of the finite element analyses are presented in this paper. Options selected for the analyses of the containment models accounted for finite strain, elastic-plastic and nonlinear geometric behavior of the containment models. The data obtained during the testing of the models are compared to the analytical results for selected areas.

33338 **(SAND—84-0807C) HECTR results for Ice-Condenser Containment Standard Problem.** Haskin, F.E.; Behr, V.L.; Camp, A.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 18p. (CONF-8406124—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012810.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

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Calculations were performed to study the Ice-Condenser Containment Standard Problem for the NRC Containment Loads Working Group (CLWG). This problem is based on a TMLB' accident sequence. TMLB' denotes a transient-initiated accident in which there is total failure of both ac power and feedwater to the steam generators. MARCH 2 and CORCON Mod2 were used to predict the steam, hydrogen, carbon dioxide, and carbon monoxide sources. HECTR was used to predict the containment pressure temperature response. The results of calculations include quantitative indications of the sensitivity of containment pressure-temperature loadings to the gas source terms, the ignition criteria, and the magnitude of the steam spike following vessel breach.

33339 **(SAND—84-0839C) Procedures and objectives for testing a 1/8 scale model of a steel containment.** Koenig, L.N. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-8406124—7). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012550.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

A 1/8 scale model of a steel containment building will be tested in late summer of this year by the Containment Integrity Division of Sandia National Laboratories, Albuquerque, NM. Included in the model are pipe penetrations, personnel locks, and operable equipment hatches. The 1/8 scale model will be pressurized in steps to well above the design pressure and data taken at each step via a computer controlled data acquisition system. Strain gages, thermocouples, and displacement and pressure transducers have been placed strategically throughout the inside and outside of the model to record data on the model's response to each pressure step. Particular effort has gone into instrumenting the area around and near penetrations although regions away from penetrations are also instrumented for comparison purposes.

33340 **(SAND—84-1233C) CONTAIN calculations of containment loading of dry PWR's.** Bergeron, K.D.; Williams, D.C. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 14p. (CONF-8406124—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012901.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

As part of the NRC's effort to re-evaluate the severe accident source term, two experts' groups have been formed to consolidate information and assess the state of the art in key phenomenological areas. These are the Containment Performance Working Group (CPWG), and the Containment Loads Working Group (CLWG). The CONTAIN code has been used extensively in support of the latter group to calculate pressure and temperature loads for a variety of phenomenological scenarios for core melt accidents at two reference plants, subject to standard problem constraints established by the CLWG. The two plants are a large dry PWR (resembling Zion) and a subatmospheric PWR (resembling Surry). The accident sequence in both cases was TMLB'. Results are presented.

33341 **Nuclear reactors: powering our space future.** Buden, D.; Sullivan, J.A. (Los Alamos National Lab., NM). *Environment;* **26**: No. 1, 7-13, 36-38(Jan-Feb 1984).

Fission reactors are the logical choice for meeting the energy needs of future U.S. space missions. The past, present, and proposed space nuclear reactor programs are reviewed. The safety associated with them, as well as the U.S. and U.N. requirements designed to prevent radioactive contamination of the environment are discussed. In order to assure radiological safety, the SP-100 space nuclear power plants are programmed with long orbital lifetimes, which delay re-entry and allow time for radioactive decay. Accidents at the time of launch and concerns about reentry of the nuclear reactor after it has been operated for some time in space are presented. The review and implementation procedures used to assure that a nuclear reactor designed for launch into space conforms to all of the safety criteria and philosophy that the U.S. has adopted are outlined.

33342 **Recriticality considerations in disrupted gas-cooled fast reactor core geometry.** Rahnema, F.; Ahmad, S.A.; Kastenberg, W.E.; Pomraning, G.C. (University of California, Los Angeles School of Engineering and Applied Science, Los Angeles, California 90024). *Nuclear Technology;* **59**: No. 2, 246-255(Nov 1982).

The margin to criticality of selected distorted core configurations derived from the hypothetical loss of shutdown cooling accident in a 300-MW(electric) gas-cooled fast reactor has been investigated using two-dimensional transport theory. Configurations representing crumbled cores declad fuel columns in nearly intact geometry, and partial slumping of the fuel on the core floor with subsequent radial spreading have been studied. Three minimum postulated conditions for recriticality have been identified for the configurations characterized by declad fuel in nearly intact geometry: If the fuel is fully compacted (no spaces among the crumbled fuel pieces), then 55% of the fuel rods in the core must crumble for recriticality. If 65% of the volume in the crumbled fuel region is space occupied by fuel, then 46% of the fuel rods must be crumbled (with the remaining 54% standing erect but declad). If 28% of the volume in the crumbled fuel bed is space occupied by fuel, then 82% of the rods must crumble for recriticality. For cores that are postulated to melt and slump in a radially outward progression, the reactivity changes from a "safe shutdown" with K /SUB eff/ = 0.93 to supercritical with K /SUB eff/ = 1.103. If the compact, but molten, core spreads radially outward, the reactivity decreases to K /SUB eff/ = 1.041.

33343 **A method for propagating uncertainty in probabilistic risk assessment.** Ahmed, S.; Clark, R.E.; Metcalf, D.R. (Babcock & Wilcox Company, Nuclear Power Generation Division Lynchburg, Virginia 24505). *Nuclear Technology;* **59**: No. 2, 238-245(Nov 1982).

A method is developed to propagate uncertainties in the basic event unavailabilities through a logic model to obtain the transient overpower event unavailability. The method consists of combining probability distributions in the discrete form without performing any sampling. The results are shown to be sufficiently accurate and contain no sampling errors; the computation time is considerably less compared to Monte Carlo simulation and histogram propagation. Uncertainty propagation methods are found to be sensitive to the spread of the basic event unavailability distributions; the proposed method produces results less conservative compared to those from propagation of moments or Monte Carlo simulation.

33344 **Limit lines for risk.** Cox, D.C.; Baybutt, P. (Battelle Columbus Laboratories, 505 King Avenue Columbus, Ohio 43201). *Nuclear Technology;* **57**: No. 3, 320-330(Jun 1982).

Approaches to the regulation of risk from technological systems, such as nuclear power plants or chemical process plants, in which potential accidents may result in a broad range of adverse consequences must take into account several different aspects of risk. These include overall or average risk, accidents posing high relative risks, the rate at which accident probability decreases with increasing accident consequences, and the impact of high frequency, low consequence accidents. A hypothetical complementary cumulative distribution function (CCDF), with appropriately chosen parametric form, meets all these requirements. The Farmer limit line, by contrast, places limits on the risks due to individual accident sequences, and cannot adequately account for overall risk. This reduces its usefulness as a regulatory tool. In practice, the CCDF is used in the Canadian nuclear licensing process, while the Farmer limit line approach, supplemented by separate qualitative limits on overall risk, is employed in the United Kingdom.

33345 **Uncertainty analysis of time-dependent nonlinear systems: theory and application to transient thermal hydraulics.** Barhen, J.; Bjerke, M.A.; Cacuci, D.G.; Mullins, C.B.; Wagschal, G.G. (Oak Ridge National Laboratory, P.O. Box X Oak Ridge, Tennessee 37830). *Nuclear Science and Engineering;* **81**: No. 1, 23-44(May 1982). Contract W-7405-ENG-26.

An advanced methodology for performing systematic uncertainty analysis of time-dependent nonlinear systems is presented. This methodology includes a capability for reducing uncertainties in system parameters and responses by using Bayesian inference techniques to consistently combine prior knowledge with additional experimental information. The determination of best estimates for the system parameters, for the responses, and for their respective covariances is treated as a time-dependent constrained minimization problem. Three alternative formalisms for solving this problem are developed. The two "off-line" formalisms, with and without "foresight" characteristics, require the generation of a complete sensitivity data base prior to performing the uncertainty analysis. The "online" formalism, in which uncertainty analysis is performed interactively with the system analysis code, is best suited for treatment of large-scale highly nonlinear time-dependent problems. This methodology is applied to the uncertainty analysis of a transient upflow of a high pressure water heat transfer experiment. For comparison, an uncertainty analysis using sensitivities computed by standard response surface techniques is also performed. The results of the analysis indicate the following. Major reduction of the discrepancies in the calculation/experiment ratios is achieved by using the new methodology. Incorporation of in-bundle measurements in the uncertainty analysis significantly reduces system uncertainties. Accuracy of sensitivities generated by response-surface techniques should be carefully assessed prior to using them as a basis for uncertainty analyses of transient reactor safety problems.

33346 **Code assessment by a two-phase nozzle flow experiment.** Kedziur, F. (Kernforschungszentrum Karlsruhe GmbH, Institut fur Reaktorentwicklung (IRE) Postfach 3640, D-7500 Karlsruhe 1). *Nuclear Science and Engineering;* **81**: No. 1, 9-22(May 1982).

Stationary two-phase flow experiments at pressures up to 13 MPa and temperatures up to 600 K have been performed in a converging nozzle. The experiment is specially designed for the assessment of two-phase computer codes used in reactor safety analysis, in particular for loss-of-coolant accident blowdown calculations. An assessment by the codes DUESE, DRIX-2D, and RELAP4/MOD6 is reported. The shape of the nozzle, the instrumentation, and the experimental program are such that models and empirical parameters of a wide range of codes can be tested and determined, respectively. Results show the influence and magnitude of models and parameter variations, the effect of the dimensionality and the

difference scheme of the code, and the relevance of the models as a function of the initial conditions.

33347 **ROSA-III base test series for a large break loss-of-coolant accident in a boiling water reactor.** Tasaka, K.; Abe, N.; Anoda, Y.; Koizumi, Y.; Shiba, M. (Japan Atomic Energy Research Institute Tokai-mura, Ibaraki-ken 319-11). *Nuclear Technology;* **57**: No. 2, 179-191(May 1982).

The rig of safety assessment (ROSA)-III facility is a volumetrically scaled (1/424) boiling water reactor (BWR) system with an electrically heated core designed for integral loss-of-coolant accident (LOCA) and emergency core cooling system (ECCS) tests. It is confirmed from the experimental results obtained so far that the ROSA-III test facility can simulate major aspects of a BWR LOCA, such as boiling transition by lowering of the mixture level in the core, rewetting by the lower plenum flashing, and final quenching by the ECCS. The overall agreement between the calculated results by the RELAP5/ MOD0 code and the experimental results is good; however, the calculated lower plenum flashing rewetted the whole core and the calculated cladding temperature considerably underpredicts the measured value at the upper part of the core.

33348 **A liquid-metal fast breeder reactor core design with seed blanket modular assemblies.** Sehgal, B.R.; Fuller, E.L.; Lin, C. (Electric Power Research Institute 3412 Hillview Avenue, Palo Alto, CA 94303). *Nuclear Technology;* **57**: No. 2, 149-162(May 1982).

A liquid-metal fast breeder reactor core design employing seed-blanket-type modular assemblies is presented. The seed region contains PuO_2-UO_2 fuel and the blanket region contains depleted UO_2 fuel. These assemblies constitute the inner core while conventional mixed-oxide assemblies are employed in the outer core region. The results of design studies and analysis show that a large reduction in the sodium void reactivity can be obtained. The core fissile loading is larger than that for a homogeneous core. The analysis of an unprotected loss-of-flow (LOF) accident shows drastically reduced potential for a LOF-driven transient overpower accident. These results and conclusions are similar to those obtained for other heterogeneous core designs.

33349 **RETRAN analysis of the turbine trip tests performed at the Peach Bottom Atomic Power Station Unit 2.** Hornyik, K.; Naser, J.A. (Oregon State University, Corvallis, Oregon). *Nuclear Technology;* **57**: No. 1, 36-49(Apr 1982).

A model based on the RETRAN code was developed for analyzing the turbine trip tests performed at the Peach Bottom Atomic Power Station Unit 2, near the end of the second fuel cycle. Special features of the model include a detailed nodal description of the steam lines and the steam bypass system as needed to properly describe pressure wave phenomena caused by stop valve closure during the early phase of the transient, and dynamic effects associated with operation of the bypass. Furthermore, it is shown that the power excursion, deliberately enhanced by delayed scram, is strongly influenced by the nature of the pressure wave as it appears in the core region and by direct moderator heating effects. Good agreement between measured transients and most calculated counterparts makes this effort an important contribution toward qualification of RETRAN for this class of transients.

33350 **An assessment of TRAC-PD2 refill calculations based on Creare countercurrent flow tests.** Bott, T.F. (Los Alamos National Laboratory, Energy Division P.O. Box 1663, MS 553, Los Alamos, New Mexico 87545). *Nuclear Technology;* **57**: No. 1, 134-139(Apr 1982).

An important step in computer code development is the assessment of code capabilities through comparison of calculated results with experimental data A number of Creare countercurrent flow tests were simulated with the Transient Reactor Analysis Code (TRAC)-PD2 code to assess the emergency core coolant (ECC) lower plenum penetration and refill predictive capabilities. The tests examined in this study indicate a prediction of complete bypass and delivery at countercurrent steam flows where these phenomena occurred experimentally. Steam flows leading to partial delivery experimentally did not always lead to partial delivery in the calculations, however. A number of parameters can potentially effect TRAC refill calculations. Sensitivity studies indicate the TRAC results are most sensitive to droplet Weber number variations that affect interfacial shear and heat transfer rates. The condensation model also affects calculations with subcooled ECC liquid.

33351 **EROS: an Experimental Breeder Reactor II operational safety code.** Dean, E.M.; Larson, H.A. (Argonne National Laboratory, P.O. Box 2528, Idaho Falls, Idaho 83401). *Nuclear Technology;* **57**: No. 1, 7-19(Apr 1982).

The EROS computer code is described as a verified program for operational safety reactor events in the normal operating or mild upset range of Experimental Breeder Reactor II (EBR-II). Following a description of EROS, several cases of verification of experimental events with the code are presented. The code is found to adequately represent reactivity perturbations in EBR-II including operational rod drops, control rod drops, and oscillator experiments. In addition, the code will interpret flow-coastdown (loss-of-pumping-power) events with great accuracy.

33352 **Behavior of impregnated charcoal filters during a two-stage accident.** Bohm, L. (Delpstrasse 3, 6940 Weinheim). *Nuclear Technology;* **56**: No. 3, 422-425(Mar 1982).

A semi-empirical model is developed that shows iodine filter behavior under normal and anomalous conditions. A two-stage accident is assumed in a 300-MW(electric) liquid-metal fast breeder reactor (LMFBR). Normal behavior is expected when there is a 10 to 30% adsorption of the inventory of ^{131}I, released during a core meltdown of the LMFBR. No serious rise in temperature and desorption is expected in the filter under normal conditions. Under anomalous conditions, however, i.e., when $>60\%$ of the ^{131}I that is released is adsorbed in the filter, high desorption and probably burning of the charcoal may result.

33353 **Transition boiling heat transfer in the Semiscale MOD-3 core during reflood.** Loomis, G.G.; Shumway, R.W. (EG & G Idaho, Inc. Idaho National Engineering Laboratory, Idaho Falls, Idaho 83415). *Nuclear Technology;* **56**: No. 3, 426-433(Mar 1982).

Transition boiling heat transfer data from Semiscale Mod-3 gravity feed reflood experiments have been compared to existing transition boiling correlations. The existing correlations were found to be inadequate for predicting the Semiscale rod bundle data; therefore, a new correlation for transition boiling was developed. The new correlation is applicable for boiling water with stainless steel, electrically heated vertical rods in a pressure range of 138 to 414 kPa. When the new transition boiling correlation is combined with the Berenson film boiling correlation, a good fit to Semiscale reflood data results.

33354 **Gap conductance and temperature transients in modified pulse design experiments.** Chandola, V.K.; Loyalka, S.K. (University of Missouri-Columbia, Nuclear Engineering Department Columbia, Missouri 65211). *Nuclear Technology;* **56**: No. 3, 434-446(Mar 1982).

Computation of nuclear reactor fuel behavior under normal and off-normal conditions is influenced by gap conductance models. In this paper the gap conductance results obtained by the use of the GAPHTR model and a new model that has a more sound theoretical basis in the jump regime are compared for small gaps with the modified pulse design experimental data. The new model is found to provide a better and more satisfactory prediction of the experimental data.

33355 **The DSNP simulation language and its application to liquid-metal fast breeder reactor transient analyses.** Saphier, D.; Madell, J.T. (Soreq Nuclear Research Centre, Yavne). *Nuclear Technology;* **56**: No. 3, 493-506(Mar 1982).

A new, special purpose block-oriented simulation language, the Dynamic Simulator for Nuclear Power Plants (DSNP), was used to perform a dynamic analysis of several conceptual design studies of liquid metal fast breeder reactors. The DSNP being a high level language enables the user to transform a power plant flow chart directly into a simulation program using a small number

of DSNP statements. In addition to the language statements, the DSNP system has its own precompiler and an extensive library containing models of power plant components, algorithms of physical processes, material property functions, and various auxiliary functions. The comparative analysis covered oxide-fueled versus metal-fueled core designs and loop- versus pool-type reactors. The question of interest was the rate of change of the temperatures in the components in the upper plenum and the primary loop, in particular the reactor outlet nozzle and the intermediate heat exchanger inlet nozzle during different types of transients. From the simulations performed it can be concluded that metal-fueled cores will have much faster temperature transients than oxide-fueled cores due mainly to the much higher thermal diffusivity of the metal fuel. The transients in the pool-type design (either with oxide fuel or metal fuel) will be much slower than in the loop-type design due to the large heat capacity of the sodium pool. The DSNP language was demonstrated to be well suited to perform many types of transient analysis in nuclear power plants.

33356 **The prediction of transient fission-gas release and fuel microcracking under severe core-accident conditions.** Rest, J. (Argonne National Laboratory, Materials Science Division Argonne, Illinois 60439). *Nuclear Technology;* **56**: No. 3, 553-564(Mar 1982).

The interrelationship between fuel fracturing (microcracking), temperature scenario, and fissiongas-bubble response is investigated. The fission-gasbubble behavior is described using the FASTGRASS computer code. A model, based on the work of DiMelfi and Deitrich describing ductile/brittle fuel behavior, has been incorporated into the FASTGRASS analysis. The predictions of fission-gas release, radial distribution of released gas, radial distribution of microcracking, and fuel temperatures are compared with the results of transient direct-electrical-heating experiments on irradiated light water reactor fuel. Finally, results of analyses for Three Mile Island Unit 2 type accident conditions are presented and implications for microcracking and fission-gas behavior during this accident are discussed.

33357 **The effect of time delays in fuel pin failure on LOF-TOP transient calculations for a commercial-sized LMFBR.** Pizzica, P.A.; Hummel, H.H. (Argonne National Laboratory, 9700 S. Cass Ave., Argonne, Illinois 60439). *Nuclear Technology;* **56**: No. 2, 313-321(Feb 1982).

Various loss-of-flow cases have been calculated for a commercial-sized liquid-metal fast breeder reactor. Particular attention has been paid to the development of loss-of-flow-driven transient-overpower (LOF-TOP) conditions. In such conditions, it is crucial to consider when an initial cladding breach might occur in LOF-TOP pins and over what length of time the initial cladding breach might extend in fuel pins failing under burst pressure. This study shows that the neutronic energy deposition in transient calculations including LOF-TOP pin failures can increase substantially compared to a calculation excluding such LOF-TOP failures in two ways. First, there will be an increase if there is no extension of an initial cladding failure in LOF-TOP pins or if there is a relatively long delay in the extension. Secondly, when, in applying a fuel melt fraction criterion for pin failure, the same melt fraction is specified for failure extension as for initial failure, which implies a certain delay time for failure extension, there will be an increase in the energy deposition compared to the case without any LOF-TOP failures only when the specified fuel melt fraction becomes very large. However, even in the case with the largest failure melt fraction, there will be no increase in energy deposition when a rapid enough failure extension is assumed. These calculations make a number of very conservative assumptions. The purpose of the study is not to provide a best estimate of accident conditions but to show how quickly an initial cladding breach must extend in such conservative calculations if it is to limit the increase in neutronic energy deposition.

33358 **Analyzing the rod drop accident in a boiling water reactor.** Cheng, H.S.; Diamond, D.J. (Brookhaven National Laboratory, Department of Nuclear Energy Upton, New York 11973). *Nuclear Technology;* **56**: No. 1, 40-54(Jan 1982).

The center rod drop accident was calculated for a boiling water reactor using the two-dimensional (R,Z) core dynamics code BNL-TWIGL. Analysts frequently neglect moderator feedback under the assumption that it leads to conservative results. The present study shows that the peak of the power burst and peak fuel enthalpy can indeed be reduced by a factor of 2 or more by including this effect. The magnitude of the effect depends on reactor conditions. Moderator feedback is particularly important when there are voids in the core initially (i.e., at power conditions) or when the core is near saturation condition. When the reactor is initially at zero power and considerably subcooled, moderator feedback will influence the power peak by $< 10\%$ but will have a much larger effect on the peak fuel enthalpy, which occurs later in time. The moderator feedback is the result of heat conducted from the fuel rod and direct energy deposition. At power conditions, the time constant for heat conduction is small and this is the primary mechanism for changing the steam void content during the accident. At zero power, the initial thermal constant is very large and, hence, any generation of voids at short times is due to direct energy deposition in the moderator. The effect of a different initial power level, flow rate, and inlet subcooling, as well as the effect of delayed neutron fraction, rod drop speed, and accident rod worth, was calculated. In all cases, with moderator feedback accounted for, the maximum fuel enthalpy during the accident is well below presently established limits. Accident consequences are insensitive to the delayed neutron fraction and rod drop velocity. The parameters of most significance are inlet subcooling and accident rod worth.

33359 **The critical safety functions and plant operation.** Corcoran, W.R.; Church, J.F.; Cross, M.T.; Guinn, W.M.; Porter, N.J. (Combustion Engineering, Inc., 1000 Prospect Hill Road Windsor, Connecticut 06095). *Nuclear Technology;* **55**: No. 3, 690-712(Dec 1981).

The operator's role in nuclear safety is outlined and the concept of "safety functions" introduced. Safety functions are a group of actions that prevent core melt or minimize radiation releases to the general public. They can be used to provide a hierarchy of practical plant protection that an operator should use. The plant safety evaluation uses four inputs in predicting the results of an event: the event initiator, the plant design, the initial plant conditions and setup, and the operator actions. If any of these inputs are not as assumed in the evaluation, confidence that the consequences will be as predicted is reduced. Based on the safety evaluation, the operator has three roles in assuring that the consequences of an event will be no worse than the predicted acceptable results: Maintain plant setup in readiness to properly respond. Operate the plant in a manner such that fewer, milder events minimize the frequency and the severity of adverse events. Monitor the plant to verify that the safety functions are accomplished. The operator needs a systematic approach to mitigating the consequences of an event. The concept of safety functions introduces this systematic approach and presents a hierarchy of protection. If the operator has difficulty identifying an event for any reason, the systematic safety function approach allows accomplishing the overall path of mitigating consequences. Ten functions designed to protect against core melt, preserve containment integrity, prevent indirect release of radioactivity, and maintain vital auxiliaries needed to support the other safety functions are identified.

33360 **Probability level of readiness in supervised protective systems for nuclear reactors.** Kontoleon, J.M. (University of Wollongong, Department of Electrical Engineering Wollongong, New South Wales 2500). *Nuclear Science and Engineering;* **73**: No. 1, 84-86(Jan 1980).

The readiness of supervised protective systems for nuclear reactors is analyzed by the use of a four-state Markov process. The supervisions are short and reveal the capability of the system to initiate the protection action. When this capability--defined as the probability of initiating the protection action-is found to be below an acceptable level, the reactor is shut down. The analysis interrelates the probability level of readiness with the desired readiness of the protection system and its rate of supervision.

25 ENERGY STORAGE

2501 Magnetic

REFER ALSO TO CITATION(S) 34934, 34935

2502 Compressed Gas

REFER ALSO TO CITATION(S) 33367

33361 **(PB—84-169200) Stored energy management for regenerative braking applications.** Russell, F.M. (Rutherford Appleton Lab., Chilton (UK)). 1984. 14p. (RL—83-128). NTIS, PC E03/MF E03.

The use of regenerative braking devices to conserve energy during repeated speed changes of vehicles is well known. Practical systems based on electrical energy storage in batteries and kinetic energy storage in flywheels have been developed to the commercial stage. The alternative of a pneumatic system using compressed air storage is examined here. A procedure involving stored energy management is proposed which beneficially increases both the volume density of energy storage and the volume power density of the associated compressor/expander unit.

2504 Capacitor Banks

33362 **(SAND—84-0269C) 50 kJ repetitively pulsed capacitor bank.** Robwein, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 10p. (CONF-8406137—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012959.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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A 50 kJ capacitor bank designed for continuous rep-rated operation has been built and tested. The bank is a low inductance dual polarity arrangement with 26 parallel spark gap switches. The multiple switches and isolated capacitor pairs contribute to long life and high operational reliability, which were two primary design goals.

2505 Flywheels

REFER ALSO TO CITATION(S) 33233

2506 Thermal

REFER ALSO TO CITATION(S) 32952

33363 **(DFVLR-FB—84-03) Development of media for dynamic latent heat storage for the low temperature range. Pt. 1.** Kanwischer, H.; Tamme, R. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.). Inst. fuer Technische Physik). 1984. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751770.

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The results of the thermoanalytically measured phase change temperatures and phase change enthalpies of seventeen salt hydrates, three double salts, and four eutectics are reported. Good results are obtained especially for congruently melting salt hydrates. Incongruently melting salt hydrates appear less suitable for heat storage applications. The influence of the second phase - water, acid, and hydroxide - to the latent heat is described. From the results, basic values of the working temperatures and storage capacities of various storage media compositions may be derived.

33364 **(FRNC-TH—1459) Study of aquifer storage: conductive modelling of a radial symmetry system in a stratified medium.** Lamant, D. (Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France)). Sep 1983. 219p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84751732.

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In this report, various kind of numerical modelling or analytical modelling of aquifer thermal energy storage are listed, insisting for each description on the physical (thermal and hydraulic) phenomena involved and on the limits of the description. The main influent parameters for conduction and convection heat transfer are pointed out. Their relative influence is investigated. A new code is developed to take into account the influence of horizontal impervious layers or heterogeneities in the aquifer.

33365 **(IKE—5-218) Theoretical and experimental investigation of the thermal behaviour of a high-temperature latent heat storage system with sodium nitrate as heat storage medium.** Gadhia, B. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Jan 1984. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751773.

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The theoretical analysis employs a quasi-two-dimensional mathematical model which includes a specially developed iteration method. The mathematical model was used to investigate the freezing behaviour of the storage medium surrounding a long gas cooled heat exchanger tube imbedded in the tube-and-shell-type storage system. The experimental investigations cover melting and freezing experiments with different mass flow rates of air as heat exchange medium flowing in the tube. The total height of the storage system is about 1,58 m and its diamter is 0,1 m. The diameter of the coaxially arranged heat exchanger tube is 0.025 m. The storage system is filled with about 24,5 kg of sodium nitrate. The total thermal capacity (latent heat + sensible heat) of the storage system is 14330 kJ (i.e. 4,0 kWh) within the operating temperature range from 50°C to 350°C. Experiments were also conducted to determine the heat losses by cooling the storage system through natural convection (i.e. heat loss through insulation only).

33366 **(PNL—5067) Seasonal thermal energy storage.** Allen, R.D.; Kannberg, L.D.; Raymond, J.R. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013854.

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This report describes the following: (1) the US Department of Energy Seasonal Thermal Energy Storage Program, (2) aquifer thermal energy storage technology, (3) alternative STES technology, (4) foreign studies in seasonal thermal energy storage, and (5) economic assessment.

33367 **(PNL—5127) Underground Energy Storage Program. 1983 annual summary.** Kannberg, L.D. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 52p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013628.

The Underground Energy Storage Program approach, structure, history, and milestones are described. Technical activities and progress in the Seasonal Thermal Energy Storage and Compressed Air Energy Storage components of the program are then summarized, documenting the work performed and progress made toward resolving and eliminating technical and economic barriers associated with those technologies. (LEW)

2509 Batteries

REFER ALSO TO CITATION(S) 32869, 32870, 32871, 33599, 33600, 33601, 33602, 33603, 33604, 33605, 33606, 33607, 33608, 33738

33368 **(AD-A—138791/9) Use of a polyacetylene cathode in primary lithium-thionyl chloride cells.** (Geo-Centers, Inc., Newton Upper Falls, MA (USA)). Oct 1983. 64p. (GC-TR—83-281). NTIS, PC A04/MF A01.

This report describes the work performed for the Navy with regard to the use of poly(acetylene), (CH)x, as a cathode material in a lithium/thionyl ($Li/SOCl_2$) battery. The objective of the project was three fold: (1) To characterize and understand the electrochemistry of (CH)x in a detailed manner, (2) To study the com-

patibility of (CH)x with $SOCl_2$ and (3) To synthesize and investigate 'modified' (CH)x polymers which may possess more desirable properties than the parent polymer.

33369 **(CONF-840677—1) Testing activities at the National Battery Test Laboratory.** Hornstra, F.; DeLuca, W.H.; Gay, E.C.; Yao, N.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013435.

From 6. DOE battery and electrochemical contractors' conference; Washington, DC, USA (25 Jun 1984).

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The project objective is to acquire and to provide information on battery performance and lifetime under uniform test conditions and conditions that simulate load profiles in the intended application; to determine the effects of temperature and depths of discharge on performance and lifetime; to provide data for battery analyses and modeling; and to provide other information as required by the ongoing battery development program.

33370 **(CONF-840677—2) Glass electrolytes.** (Argonne National Lab., IL (USA)). 25 Jun 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013428.

From 6. DOE battery and electrochemical contractors' conference; Washington, DC, USA (25 Jun 1984).

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The objective of this research is a glass electrolyte for use in sodium/sulfur batteries that has a low resistivity (100 ohm-cm at 300°C) and is stable in the cell environment. Experiments in this program are focussed on glasses in the quaternary system: soda, alumina, zirconia and silica. The FY 1983 research on glass analogs of NASICON, parallel thermodynamic calculations, and a review of the literature in the areas of glass conductivity and corrosion resistance led to selection of this system for more detailed investigation. The main program elements are: (1) conductivity measurements at 300 to 500°C; (2) differential thermal analysis for determination of glass-transition and crystallization temperatures; (3) static corrosion tests at 400°C using Na, Na_2S_4, and S; (4) mechanical strength and fracture toughness measurements; and (5) sodium/sulfur cell tests at 350°C. Elements (1) and (2) are nearly completed; element (3) is being initiated using the glasses prepared for (1) and (2), and elements (4) and (5) will begin in the first and second quarters of FY 1985, respectively. Fourteen quaternary glasses having a broad range of compositions have been made. The resistivities of these glasses at 300°C extended from 130 to 3704 ohm-cm; the activation energies for conduction extended from 0.488 to 0.684 eV, and the glass transition temperatures extended from 397 to 685°C. Through a multiple linear regression analysis of these data response surfaces were generated for resistivity, activation energy for conduction, and glass transition temperature over the composition region within the quaternary system that is bounded by SiO_2, Na_2O_3, Na_2AlO_4 and Na_2ZrO_3. These response surfaces indicated a new region of high conductivity and high glass transition temperature in the neighborhood of 42% soda, 31% silica and 27% alumina plus zirconia.

33371 **(CONF-840677—3) Lithium-alloy/metal sulfide battery research.** Redey, L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013427.

From 6. DOE battery and electrochemical contractors' conference; Washington, DC, USA (25 Jun 1984).

The results of measurements on small electrodes in the half-cell experiments and on large electrodes (50 to 160 cm^2) in compact cell studies (ANL results reported in 1979 to 1982) have been proven comparable in terms of area-specific resistances of the electrode bed. Also, post-test optical analysis showed comparable microstructure of the small and large electrodes. The measured area-specific resistances and capacities of the ternary Li-Al-Si alloy and the iron and nickel sulfide electrodes with high-sulfur activity indicate a possibility for designing a new generation of Li-alloy/metal sulfide cells. With proper combination of the tested active materials and electrolytes, a 50 to 100% performance increase relative to the Li-Al/FeS cells can be expected. Cell designs are being developed to study the interaction of the positive and negative electrodes (capacity matching, self discharge) in small compact cells. These studies, to be initiated in the near future, will provide the basis for selection of an optimum combination of the chemical compositions and loading densities of electrodes.

33372 **(CONF-840677—Suppl.) Project summaries: sixth DOE electrochemical contractor's review. Supplement.** (Battelle Columbus Labs., OH (USA); Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013678.

From 6. DOE battery and electrochemical contractors' conference; Washington, DC, USA (25 Jun 1984).

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This document represents a compilation of project summaries of research supported by the Electrochemical Storage Program from January 1983 through June 1984. It is intended to be a technical overview for engineers and scientists in government, industry and academia who are interested in finding out more about this program. Overview, Sodium-Sulfur Battery, Battery Performance and Testing, Battery Analysis, Flow Batteries, Lithium Rechargeable Batteries, Alkaline Batteries, Metal-Air Batteries, Fuel Cells and Electrochemical Processes.

33373 **(CONF-840804—23) Thermal management of a lithium/iron-sulfide battery.** Shimotake, H.; Chilenskas, A.A.; Malecha, R.F.; Yao, N.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013438.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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A thermal management design analysis has been completed for a Li-Al/FeS battery. High efficiency thermal insulation is used to insulate the battery case which keeps heat loss to an acceptable level while maintaining the battery at its proper operating temperature of the battery during startup, normal operation, and standby duty. Computer assisted thermal modeling supported by experimental data show that the temperature uniformity of the cells in a 162-cell battery can be kept within 16C under anticipated operating conditions.

33374 **(CONF-840804—24) Effects of standtime on the available capacity of lead-acid and nickel/iron electric vehicle batteries.** DeLuca, W.H.; Tummillo, A.F.; Biwer, R.L.; Yao, N.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013452.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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In electric vehicle (EV) applications, the battery load typically contains interruptions of various time durations. These standtimes affect the battery's available capacity and must be understood in order to predict and optimize vehicle operation. Laboratory tests were conducted to measure the impact of various standtimes (0-4 h) at different depth-of-discharge (DOD) and state-of-charge (SOC) levels on the capacity retention of both improved lead-acid and nickel/iron (Ni/Fe) EV batteries. The results showed that the Ni/Fe system exhibits a self-discharge capacity loss immediately after charging that increases with both standtime and SOC. Fortunately, the self-discharge rate decreases rapidly with standtime and discharging. Standtimes after charging also decrease the available capacity of the lead-acid system due to reduced battery temperatures. However, standtimes at DOD levels > 50% provide an increase in battery capacity by allowing for the relaxation of electrolyte concentration gradients. This paper describes the test procedures used, presents the test data, and discusses the results.

33375 **(CONF-840853—1) Chemical stability of beta-alumina.** Smaga, J.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009635.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

Beta-alumina tubes can fracture under conditions which arise during the operation of Na/S cells. Several models, based on sodium ion focusing at the crack tip, have been proposed to explain the failure mode and are discussed in recent papers. In this study, two beta-alumina compositions that are used in developmental cells were immersed in molten sodium to differentiate the chemical effects of electrolyte degradation from the electrochemical ones. Tests were also conducted in sodium polysulfide melts because electrolyte deterioration on the sulfur side has also been reported.

33376 **(CONF-840853—2) Electrochemical performance of porous nickel sulfide electrodes.** Redey, L.; Vissers, D.R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009586.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

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The objective of this study has been to characterize the electrochemical performance (utilization and voltage loss) of porous nickel sulfide electrodes in molten salt electrolytes.

33377 **(CONF-840853—4) Characterization of voltage losses during high-intensity current pulses in reactive, porous electrodes of molten salt cells.** Redey, L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012112.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

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A technique for the rapid characterization of the power-related properties of porous electrodes of molten salt cells has been developed. In this method, the electrode properties were investigated under one-dimensional current-distribution conditions in small test cells of 0.3 to 1.5 Ah capacity. The electrode potential was measured against a Ni/Ni_3S_2 or Li-Al reference electrode located so that the IR-voltage drop was eliminated. At different states of charge, galvanostatic discharge or charge current pulses of different intensity and duration were applied to the electrode by high-precision power sources. The state of charge for the electrode was determined from the quantity of the coulombs passed in galvanostatic cycling and is indicated in this paper by the numeric value of x in the generic formula of the active material (e.g., x in FeS/sub x/). Electrode materials iron sulfide, nickel sulfide, Li-Al and Li-Si alloys in LiCl-KCl and LiF-LiCl-LiBr molten salt electrolytes were investigated.

33378 **(CONF-840853—5) Recent results from the National Battery Test Laboratory.** Hornstra, F.; Yao, N.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012110.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

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The National Battery Test Laboratory (NBTL) is an Argonne National Laboratory facility for testing, evaluating, and studying advanced electric storage batteries. The facility tests batteries developed under Department of Energy programs and from private industry. These include batteries intended for future electric vehicle (EV) propulsion, electric utility load leveling, and solar energy storage. This paper will focus on the testing of EV batteries as this application is the most demanding and requires the most versatile test program. The NBTL was established in 1977 and became operational in 1978. It is computer automated and operates around-the-clock. The facility has room for the simultaneous testing of about 76 batteries, each independently operated, under various environmental conditions and over a wide range of voltages and currents. The NBTL has four major components as follows: (1) The control room and main test area where ambient and elevated temperature testing are conducted. (2) The environmental annex where low temperature chambers and a Zn/Cl test facility (with halogen scrubber) exist. (3) The Battery Components Technology (BCT) Laboratory where special instrumentation and software are installed to allow systematic parametric variation and optimization and other refined studies. (4) The recently added high temperature test area where Li/S and Na/S cells are under evaluation.

33379 **(CONF-840853—6) Inelastic neutron scattering study of β-PbO_2: recent results.** Varma, R.; Eckert, J.; Maroni, V.A.; Giordano, C.; Goldstone, J.A.; Cehelnik, T. (Argonne National Lab., IL (USA); Los Alamos National Lab., NM (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012107.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

Electrochemical activity of lead dioxide electrode in the lead-acid battery system may be related to the incorporation of hydrogen defect in the material. The coherent and incoherent neutron-scattering cross sections of Pb, O, and H atoms are sufficiently different from each other to assure meaningful results from neutron scattering studies. A preliminary analysis of experimental results of inelastic incoherent neutron scattering (IINS) study on β-PbO_2 (Space Group P_{42} mnm) from cycled lead-acid battery plates, in addition to yielding the vibrational spectrum representative of motions of Pb and O atoms in the crystal lattice, provided for the first time the evidence for the presence of tightly bound protons in the solid phase. We report in this paper on the observed vibrational modes for β-PbO_2 material prepared chemically and obtained from cycled battery plates.

33380 **(LBL—17742) Technology Base Research Project for electrochemical energy storage. Annual report for 1983.** Kinoshita, K. (ed.). (Lawrence Berkeley Lab., CA (USA)). 18 May 1984. Contract AC03-76SF00098. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013877.

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The Lawrence Berkeley Laboratory (LBL) is the Lead Center for management of the Technology Base Research (TBR) Project, which is supported by DOE's Office of Energy Systems Research, Energy Storage Division. The purpose of this project is to provide the research base which supports DOE efforts to develop electrochemical technology for electric vehicle and stationary energy storage applications. The general objective of the TBR project is to help provide advanced electrochemical systems that can satisfy stringent performance and economic requirements for electric vehicle and stationary energy storage applications. The specific goal of the project is to identify the most promising electrochemical technologies and transfer them to industry and/or another DOE program for further development and scale-up. General problem areas addressed by the project include identification of new electrochemical couples for advanced batteries, determination of technical feasibility of the new couples, improvements in battery components and materials, establishment of engineering principles applicable to electrochemical energy storage and conversion, and the assessment of fuel cell technology for transportation applications. Major emphasis is given to applied research which will lead to superior performance and lower life-cycle costs. The TBR project is divided into four major project elements: Electrochemical Systems Research, Supporting Research, Electrochemical Processes, and Fuel Cells for Vehicles. This report summarizes the research, financial, and management activities relevant to the TBR project in CY 1983. Highlights of each project element are summarized according to the appropriate battery system or electrochemical research area.

33381 **(LBL—17776) General energy balance for battery systems.** Bernardi, D.; Pawlikowski, E.; Newman, J. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 43p. (CONF-841058—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013235.

From Fall meeting of the Electrochemical Society; New Orleans, LA, US (7 Oct 1984).

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A general energy balance for battery systems has been developed. This equation is useful for estimating cell thermal characteristics. Reliable predictions of cell temperature and heat generation rate are required for the design and thermal management of battery systems. The temperature of a cell changes as a result of electrochemical reactions, phase changes, mixing effects, and joule heating. The equation developed incorporates these effects in a complete and general manner. Simplifications and special cases are

discussed. The results of applying the energy balance to a mathematical model of the LiAl/FeS cell discharged through two different reaction mechanisms are given as examples. The examples illustrate how the energy equation may be applied to a specific system to examine the relative contributions corresponding to the terms in the equation. The examples show that the processes involved in cell heat generation may be complex and that the application of a sufficiently general energy equation is advantageous.

33382 **(PB—84-187723) Evaluation of a 96v globe ev 1000 battery pact at temperature extremes. Final report.** Nowak, D. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Aug 1983. 33p. (UAH—376). NTIS, PC A03/MF A01.

Sponsored in part by Aerospace Corp., Washington, DC.

Tests with a 96V GLOBE EV 1000 battery were conducted to measure the effects of temperature extremes on the performance of EV batteries. The test objectives were to assess the nature and extent of problems encountered at various operating temperatures and to provide the engineering data base for the elimination of the problems.

33383 **(PB—84-187731) Evaluation of an 96v ALCO 2200 battery pack at temperature extremes. Final report.** Nowak, D. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Jun 1983. 34p. (UAH—368). NTIS, PC A03/MF A01.

Sponsored in part by Aerospace Corp., Washington, DC.

Tests with a 96 V ALCO 2200 battery were conducted to measure the effects of temperature extremes on the performance of EV batteries. The test objectives were to assess the nature and extent of problems encountered at various operating temperatures and to provide the engineering data base for the elimination of the problem.

33384 **(PB—84-187749) Evaluation of an 96v Exide XPV23-3 battery pack at temperature extremes. Final report.** Nowak, D. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Apr 1983. 59p. (UAH—367). NTIS, PC A04/MF A01.

Sponsored in part by Aerospace Corp., Washington, DC.

Tests with a 96V Exide XPV23-3 battery were conducted to measure the effects of temperature extremes on the performance of EV batteries. The test objectives were to assess the nature and extent of problems encountered at various operating temperatures and to provide the engineering data base for the elimination of the problems.

33385 **(SAND—83-2273C) Multicell Li/$SOCl_2$ reserve battery.** Baldwin, A.R.; Garoutte, K.F. (Sandia National Labs., Albuquerque, NM (USA); Honeywell, Inc., Horsham, PA (USA). Power Sources Center). 1984. Contract AC04-76DP00789. 11p. (CONF-8406119—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012812.

From 31. power sources symposium; Cherry Hills, NY, USA (12 Jun 1984).

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Recent development work on reserve lithium thionyl chloride (RLTC) batteries at SNLA and Honeywell has included safety and performance evaluations. The RLTC battery is being considered for applications that have traditionally been fulfilled by state-of-the-art thermal batteries and reserve silver oxide zinc electrochemical systems. These applications typically demand a reserve battery having a rapid voltage rise, high reliability, operational safety and useful active lifetime ranging from minutes to hours. The RLTC work reported here was directed toward a power battery capable of meeting or exceeding the design requirements. Performance and safety test data indicate that the RLTC battery may be better suited than thermal batteries for some long-life applications. Table II presents a comparison between a Li(Si)/FeS_2 thermal battery and an RLTC battery, both of which were designed to fulfill the requirements.

33386 **(SAND—84-0982C) Review of flow battery testing at Sandia.** Butler, P.C.; Miller, D.W.; Robinson, C.E.; Rodriguez, G.P. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 13p. (CONF-840804—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011186.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Sandia National Laboratories is evaluating prototype zinc/bromine, Redox, and zinc/ferricyanide flowing electrolyte batteries and cells. This paper will update previous reports of test results of two Exxon zinc/bromine batteries and one NASA Redox iron/chromium battery. Two 60-sq. cm. zinc/ferricyanide cells from Lockheed Missiles and Space Co. are also being evaluated. Performance, life, and operating data will be described for these batteries and cells.

33387 **(SAND—84-7108) Study of bipolar batteries.** Clifford, J.E. (Battelle Columbus Labs., OH (USA)). Jun 1984. Contract AC04-76DP00789. 53p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013193.

Battelle determined the status of development of bipolar batteries having an aqueous electrolyte. Included in the study were lead-acid, nickel-cadmium, nickel-zinc, nickel-iron, and nickel-hydrogen batteries. A review of the technical and patent literature is presented along with a bibliography covering the past 15 years. Literature data are supplemented by a survey of organizations. The principal interest has been in bipolar lead-acid batteries and more recently in bipolar nickel-hydrogen batteries for space applications. There have been only limited efforts to develop bipolar batteries for electric vehicle applications. Recommendations are made for additional studies.

33388 **Cathodic overpotential of potassium in $KAlCl_4$ propylene carbonate electrolyte.** Law, H.H.; Tobias, C.W. (Univ. of California, Berkeley). *Proceedings - Electrochemical Society;* **81-82**: 1403-1404(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33389 **Evaluation of the coulostatic (current impulse relaxation) technique and comparison with other DC techniques for the determination of kinetics of electrode reactions.** Nagy, Z.; Arden, J.T. (Argonne National Lab., IL). *Proceedings - Electrochemical Society;* **81-82**: 1450-1451(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33390 **Surface spectroscopic studies of high temperature electrode reactions.** Yang, C.Y.; O'Grady, W.E. (Brookhaven National Lab., Upton, NY). *Proceedings - Electrochemical Society;* **81-82**: 1462-1464(1981). (CONF-811013—Vol.81-82-Absts). Contract AC02-76CH00016.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33391 **Recent advances in nickel-zinc cell technology.** Himy, A.; Wagner, O.C. (NAVSEA, Washington, DC). *Proceedings - Electrochemical Society;* **81-82**: 153-154(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33392 **Development of the alkaline aluminum-air fuel cell for automotive applications.** Stephens, D.E.; Morris, J.L.; Littauer, E.L. (Continental Group, Inc., Cupertino, CA). *Proceedings - Electrochemical Society;* **81-82**: 305-306(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33393 **Continuous overcharge accelerated positive grid corrosion test on lead antimony pasted flat plate cells.** Noveske, T.M.; Chreitzberg, A.M. (Exide Management and Tech. Company, Yardley, PA). *Proceedings - Electrochemical Society;* **81-82**: 13-15(1981). (CONF-811013—Vol.81-82-Absts). Contract W-31-109-ENG-38.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33394 **Shock sensitivity of discharged lithium-sulfur dioxide cells.** Levy, S.C.; Crafts, C.C. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 44-45(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33395 **Generation of thermal energy in high-temperature lithium/iron sulfide cells.** Gibbard, H.F.; Chen, D.M. (Gould Inc., Rolling Meadows, IL). *Proceedings - Electrochemical Society;* **81-82**: 129-131(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33396 **Charging studies on maintenance-free nickel-zinc cells.** Wagner, O.C.; Almerini, A.; Smith, R. (US Army Electronics Tech. and Devices Laboratory, Ft. Monmouth, NJ). *Proceedings - Electrochemical Society;* **81-82**: 157-159(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33397 **Complex impedance of $Ca/CaCrO_4$ thermal batteries.** Guidotti, R.A.; Delnick, F.M. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 194-197(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33398 **Thermal management of the iron-air battery system.** Demczyk, B.G.; Grimble, R.E. (Westinghouse Research and Development Center, Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 302-304(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33399 **Parametric study of an alkaline-electrolyte aluminium-air flow cell.** Perone, S.P.; Bey, N.K.; Cooper, J.F. (Lawrence Livermore National Lab., CA). *Proceedings - Electrochemical Society;* **81-82**: 310-312(1981). (CONF-811013—Vol.81-82-Absts). Contract W-7405-ENG-48.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33400 **Recycle of battery components.** Pemsler, J.P.; Spitz, R.A. (Castle Tech. Corporation, Woburn, MA). *Proceedings - Electrochemical Society;* **81-82**: 50-52(1981). (CONF-811013—Vol.81-82-Absts). Contract AC02-80ET25206.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33401 **Structural studies of alkaline nickel electrode powders.** Jackovitz, J.F.; Seidel, J. (Westinghouse Research and Development Center, Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 66-67(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33402 **Performance of nickel cathodes as free standing electrodes in the Ni-Zn vibrocel.** Thornell, S.; Pearlman, E. (Exide Management and Technology Co., Yardley, PA). *Proceedings - Electrochemical Society;* **81-82**: 103-105(1981). (CONF-811013—Vol.81-82-Absts). Contract W-31-109-ENG-38.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33403 **Effect of inorganic additives on zinc electrodes in alkaline batteries.** McBreen, J.; Gannon, E. (Brookhaven National Lab., Upton, NY). *Proceedings - Electrochemical Society;* **81-82**: 160-161(1981). (CONF-811013—Vol.81-82-Absts). Contract AC02-76CH00016.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33404 **Elastomeric binder for TiS_2 cathodes in secondary lithium cells.** Yen, S.P.S.; Shen, D.; Somoano, R.B. (California Inst. of Technology, Pasadena). *Proceedings - Electrochemical Society;* **81-82**: 177-178(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33405 **Electrochemical domain of the components of ambient temperature secondary lithium batteries.** Yen, S.P.S.; Shen, D.; Williams, R.M.; Somoano, R.B. (California Inst. of Technology, Pasadena). *Proceedings - Electrochemical Society;* **81-82**: 179-180(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33406 **Oxygen electrode in metal air batteries.** Yeager, E.; Tryk, D.; Ohzuku, T.; Molla, J.; Aldred, W. (Case Western Reserve Univ., Cleveland, OH). *Proceedings - Electrochemical Society;* **81-82**: 265-267(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33407 **Electrochemistry of perovskites.** Wang, B.C.; Molla, J.; Aldred, W.; Yeager, E. (Case Laboratories for Electrochemical Studies, Cleveland, OH). *Proceedings - Electrochemical Society;* **81-82**: 280-282(1981). (CONF-811013—Vol.81-82-Absts).

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33408 **Gas transport study of bifunctional air electrodes.** Liu, C. (Westinghouse Electric Corp., Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 292(1981). (CONF-811013—Vol.81-82-Absts).

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33409 **Catalytic systems for bifunctional oxygen electrodes.** Ohzuku, T.; Tryk, D.A.; Yeager, E.B. (Case Western Reserve Univ., Cleveland, OH). *Proceedings - Electrochemical Society;* **81-82**: 293-294(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33410 **Silver retention in carbon-based bifunctional air electrodes.** Gibney, A.; Buzzelli, E.S.; Leap, G.D. (Westinghouse Electric Corp., Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 295-297(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33411 Anodic dissolution of aluminum and aluminum alloys: effects of temperature and stannate concentration. Morris, J.L.; Tsai, K.C. (Continental Group, Inc., Cupertino, CA). *Proceedings - Electrochemical Society;* **81-82**: 318-319(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33412 Use of on-line digital signal analysis approach to characterize corroding electrodes. Hager, J.; Pohlman, S.; Fortune, R.; Russell, P. (Solar Energy Research Inst., Golden, CO). *Proceedings - Electrochemical Society;* **81-82**: 331-332(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33413 First generation of bubbles on gas-evolving electrodes. Cettou, P.; Sides, P.J.; Tobias, C.W. (Univ. of California, Berkeley). *Proceedings - Electrochemical Society;* **81-82**: 1403-1404(1981). (CONF-811013—Vol.81-82-Absts). Contract W-7405-ENG-48.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33414 Morphological comparison of Li-Al and Li-Si electrodes in LiCl-KCl eutectic electrolyte. Fischer, A.K.; Vissers, D.R. (Argonne National Lab., IL). *Proceedings - Electrochemical Society;* **81-82**: 1416-1418(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33415 High temperature emf measurements on the Li-Al/Ni_3S_2 couple. Tomczuk, Z.; Redey, L.; Vissers, D.R. (Argonne National Lab., IL). *Proceedings - Electrochemical Society;* **81-82**: 1419-1421(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33416 Lead deficiency and hydrogen content in lead dioxide battery-active material. Jorgensen, J.D.; Varma, R.; Rotella, F.J.; Cook, G.; Yao, N.P. (Argonne National Lab., IL). *Proceedings - Electrochemical Society;* **81-82**: 1458-1459(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33417 Metal sulfide and metal sulfide-lithium sulfide mixtures as positive electrode materials for high energy density batteries. Schertz, W.W.; Gay, E.C.; Martino, F.J.; Anderson, K.E. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **121**: No. 3, 122C(Mar 1974).

From Electrochemical society meeting; San Francisco, CA, USA (12 May 1974).

An investigation of the physical and chemical properties of FeS_2 and $FeS_2 + Li_2S$ mixtures as the active materials for secondary cells with molten lithium as the negative electrode active material is reported. The mechanism of self-discharge, performance characteristics and the effects of current collection techniques were studied in specially designed cells and in cells composed of parallel plate electrodes with areas of from 5 to 20 cm^2.

33418 Semi-solid mixed cathodes for lithium/chalcogen cells. Walsh, W.J.; Cairns, E.J.; Arntzen, J.D. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **120**: No. 3, 111C(Mar 1973). (CONF-7305140—).

From Electrochemical Society meeting; Chicago, IL, USA (13 May 1973).

An electronically conductive semi-solid cathode has been developed for use in lithium/chalcogen cells containing a molten salt electrolyte. This cathode consists of a mixture of liquid sulfur, additive, and carbon black, and has been shown to be immobilized and contained within the cathode compartment. This cathode system was shown to retain its physical integrity and its electronic conductivity after repeated cycling and has yielded 1.0 A-HR/Cm^3 of cathode volume.

33419 Self regenerating storage battery. (to USAEC). British Patent 1,200,433. 29 Jul 1970. Priority date 27 Mar 1968, United States of America (USA), vp.

PAT-APPL-716,436.

The battery, has a cathode arranged in an acid solution containing plutonium ions in nitric or hydrochloric acid in concentration of 1 mole per litre in a first container to provide tetravalent plutonium cations for reduction at the cathode to trivalent cations. An anode is arranged in a second container in a similar solution of concentration 0.2 mole per litre to provide trivalent plutonium cations for oxidation at the anode to tetravalent plutonium cations. Means for ion migration between the first and second solutions is provided.

33420 Lithium-selenium secondary cells with paste electrolytes. Gay, E.C.; Trevorro, L.E.; Kyle, M.L.; Kolba, V.M.; Cairns, E.J. (Argonne National Lab., IL). pp 150-153 of Electrochemical Society fall meeting, extended abstracts. New York, NY; Electrochemical Society (1970).

From Electrochemical Society fall meeting; Atlantic City, NJ, USA (4 Oct 1970).

33421 High-rate lithium/selenium secondary cell with a fused-salt electrolyte. Shimotake, H.; Cairns, E.J. (Argonne National Lab., IL). pp 32 of 133rd meeting of the Electrochemical Society, abstracts. New York, NY; Electrochemical Society (1968). (CONF-680579—).

From 133. meeting of the Electrochemical Society; Boston, MA, USA (5 May 1968).

A secondary cell with a lithium anode, a fused LiF-LiCl-LiI electrolyte (MP 340.9°C), and a selenium cathode has been investigated at 350°-400°C, using several types of cathode current collectors. The electrode areas were 3.9 and 10 cm^2; cell capacities varied from 4 to 8.9 amp-hr, selenium being present is excess. The current density-voltage characteristics were linear with an open-curcuit voltage of 2.3-2.4v and short-circuit current densities of 11-13 amp/cm^2, corresponding to a maximum power density of 6.3-7.8 watts/cm^2. Complete recharge was achieved in less than 15 min.

33422 Performance characteristics of a lithium-tellurium cell. Shimotake, H.; Rogers, G.L.; Cairns, E.J. (Argonne National Lab., IL). pp 42-45 of Electrochemical Society 1967 fall meeting. New York, NY; Electrochemical Society Inc. (1967). (CONF-671099—).

From Electrochemical Society fall meeting; Chicago, IL, USA (15 Oct 1967).

Recently there has been a significant increase in the effort devoted to high power density and high energy density secondary cells. Examples of cells which possess both of these characteristics are the lithium-chlorine cell, the sodium-sulfur cell, and the sodium-bismuth cell. This latter cell being an example of bimetallic cells with fused-salt electrolytes, demonstrated the high current-density capabilities of bimetallic cells; however, improvements in both power density and current density were deemed necessary before bimetallic cells could be considered fully competitive.

33423 Self-discharge in alkali metal-containing bimetallic cells. Hesson, J.C.; Foster, M.S.; Shimotake, H. (Argonne National Lab., IL). pp 46-47 of Electrochemical Society 1967 fall meeting. New York, NY; Electrochemical Society Inc. (1967). (CONF-671099—).

From Electrochemical Society fall meeting; Chicago, IL, USA (15 Oct 1967).

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 34976

33424 (NP—4770323) Ireland - energy situation 1982. (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770323.

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The energy situation of Ireland is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and on the balance of payments.

33425 (NP—4770324) Burma - energy situation 1982/83. (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1984. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770324.

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The energy situation of Burma is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 32636, 33460, 33582

33426 (DOE/RA/33008—T1) Analysis of the potential for gas demand strategies. Report on evaluation of existing gas models and plan for creating a model appropriate to the needs of DOE/RA. (Lewin and Associates, Inc., Washington, DC (USA)). 23 Dec 1980. Contract AC01-79RA33008. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84012713.

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The purpose of this study is to review the state-of-the-art in gas demand modeling. The focus of the study is on the validity, policy-relevance, and flexibility of models, particularly as they relate to the issue of displacing liquid fuel imports with natural gas. The selected models for review were based on appropriateness to the reduction of liquid imports; however, a secondary goal of the study is the illustration of alternative methodology and applications. The paper begins with an expanded statement of the study focus, to suggest the range of policy questions which may benefit from gas demand modeling. Following this, eleven energy-related models are briefly reviewed by laying out each model's salient features such as: assumptions, data and algorithm; the advantages and disadvantages of each model are discussed. Information from the individual model reviews is drawn together in a final section which sets forth a set of specifications for an ideal gas demand model which would be most useful to DOE/RA in formulating policy with respect to gas demand. 16 references.

33427 (DOE/RA/50259—1) Industry functional modeling. (Polysystems Analysis Corp., Huntington, NY (USA)). Aug 1983. Contract AC01-80RA50259. 376p. NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84013514.

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Utility companies are in the predicament of having to make forecasts, and draw up plans, whose horizons lie increasingly further in the future, and they must do so in an increasingly fluid and volatile socio-economic environment. Several lines of inquiry were pursued, all intended to lead to mathematical models for these processes. The models were to be well founded conceptually, technically sound, and compatible with the uncertainties that are inherent in any description of behavioral phenomena. Three main topics are treated. One is the representation of the characteristics of the members of an organization, to the extent to which characteristics seem pertinent to the processes of interest. The second is the appropriate management of the processes of change by an organization. The third deals with the competitive striving towards an economic equilibrium among the members of a society in the large, on the theory that this process might be modeled in a way which is similar to the one for the intra-organizational ones.

33428 (ESC-WR—83-17) Calculations with the energy model SELPE: investments in four energy scenarios. van Oostvoorn, F. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Nov 1983. 20p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Calculations are made on investments in four energy scenarios accepted for basic studies in the context of the 'National Debate on Energy Policy' (MDE) by the Energy Study Centre (ESC), a department of the Netherlands Energy Research Foundation (ECN) at Petten. These calculations were made with their energy model SELPE (Static ESC Linear Programming Energy Model). Following scenarios are discussed: the Reference Scenario, Scenario for Industrial Recovery, Scenario for Redistribution of Labor, and the Scenario of the Centre for Energy Conservation. Before the representation of the results and the analyses are made, the different scenarios are described briefly and compared. Investments for the electricity generation will be important. Investments for the protection of the environment are not taken into account, except those for the restriction of sulfur dioxide emission. The total investments of the four scenarios do not differ very much, but the distribution does considerably.

33429 (ORNL—6042) Energy Division annual progress report for period ending September 30, 1983. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 192p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84013482.

This report covers work done during FY 1983 by the staff of the Energy Division and its subcontractors and by colleagues in other Oak Ridge National Laboratory divisions working on Energy Division projects. The work can be divided into four areas: (1) analysis and assessment, (2) models and data systems, (3) research to improve the efficiency of energy use and to improve electric power transmission and distribution, and (4) research utilization. Support came principally from the US Department of Energy (DOE), the US Nuclear Regulatory Commission, and the US Department of Defense, but also from a number of other agencies and organizations. Analysis and assessment included work on (a) environmental issues, including those deriving from the preparation of environmental impact statements; (b) energy and resource analysis; and (c) emergency preparedness. The models and data systems area involved research on evaluating and developing energy, environment, and engineering simulation models and on devising large data management systems, evaluating user data requirements, and compiling data bases. Research on improving the efficiency of energy use was focused primarily on the buildings and electricity sectors. A major effort on heat pump technology, which includes both heat-activated and electrically driven systems, continues. An important aspect of all the work was research utilization. Since the Energy Division is doing applied research, results are, by definition, intended to solve problems or answer questions of DOE and other sponsors. However, there are other users, and research utilization activities include technology transfer, commercialization efforts, outreach to state and regional organizations, and, of course, information dissemination.

33430 (PB—84-165547) Rural energy balance of Colombia and its socioeconomic context 1981. Torres, J.E. (Universidad de Los Andes, Bogota (Colombia). Centro de Estudios sobre Desarrollo Economico). Nov 1982. 534p. (In Spanish). NTIS, PC A23/MF A01.

This report discusses the methodology used and results obtained from a two-year study of the energy behavior of family and production units in rural Colombia. It gives a brief outline of a theoretical discussion of methodology and then an analysis of the use of energy in a sociocultural, economic, and technological context in rural areas. The methodology used to select the sample of family and productive units is given as is the criteria in the design of the questionnaire. Then the results are given for the study of 2,018 homes, extrapolated for six different energy regions. Energy consumption for agricultural and agroindustrial activities is given for eleven cultivations, including coffee. Rural industry is scarce,

mostly the production of mud bricks and tiles. The study confirms the importance of petroleum derivatives to agriculture in Colombia. All the above information is recapitulated in a countrywide conclusion.

33431 **(PB—84-166529) UK (United Kingdom) implementation of MEDEE-3. Final report.** Thomas, S. (Commission of the European Communities, Luxembourg). 1983. 76p. (EUR—8294-EN). NTIS, PC E05/MF E05.

MEDEE-3 was developed as a model to permit long-term energy demands within the EEC to be estimated. Its application to the UK economy is discussed. The data base for the model was compiled from data for 1975 and a detailed case study providing forecasts for 1980-2000 was completed. The data for 1980 and the predictions for 1990 and 2000 were compared with Department of Energy predictions and figures for 1980. These results show general agreement although some discrepancies arise. Whilst some of the model details require adjustment and problems have been identified with the input data, most of the discrepancies arise because of changed assumptions.

33432 **Disaggregating input-output models.** Wolsky, A.M. (Argonne National Lab., IL). *Review of Economics and Statistics;* **66**: No. 2, 283-291(May 1984). Contract W-31-109-ENG-38.

A general solution is given to the problem: with little computation, construct a more disaggregated input-output model from an available model, using information about some activities that were aggregated when the available model was built. The solution is exact and explicit. When only partial information is available, the exact solution guides its user to inexpensive and precise sensitivity analysis. Detailed consideration is accorded to the solution of the most frequently occurring problem: the disaggregation of one sector into two. 14 references.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 32660, 32662, 32678, 32679, 33432, 33466, 34977

33433 **(DOE/RA/50258—1) Systems economics for industry functional modeling. Second annual technical report.** Luenberger, D.; McEntire, P.; Duffie, D. (Systems Control Technology, Inc., Palo Alto, CA (USA)). Dec 1982. Contract AC01-80RA50258. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84011443.

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The three chapters of this report cover three distinct topics: dynamic markets, foundational issues in descriptor variable theory, and technological investment. The first of these, dynamic markets, represents a major effort in the synthesis of technological-economic modeling as discussed above. It is close in spirit to the models of optimal control theory that have been so successful in dynamic decision making, but it also captures the economic effects of markets. The second topic, foundational issues in descriptor variable theory, continues our basic research on descriptor variables that is fundamental to our models. The third topic, technological investment, represents a continuation of our basic work on the theory of investment within a firm. The pattern of research presented in this report is therefore consistent with our general research strategy. The first topic represents our best current work on the synthesis of technological and economic considerations, while the second two topics each represent further research on the individual components.

33434 **(DOE/RA/50258—2) Systems economics for industry functional modeling.** (Systems Control Technology, Inc., Palo Alto, CA (USA)). Aug 1983. Contract AC01-80RA50258. 170p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013542.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

This report has contributed to the theoretical development of an approach to industry functional modeling that emphasizes the economics in technological planning, operation, and project selection. The body of this final report is organized into six chapters. Chapter 2, A Composite Investor Criterion for Capital Budgeting, and Chapter 4, Technological Investments, discuss methods for selecting technological projects from an economic standpoint. Chapter 3, Foundational Issues in Descriptor Variable Systems, extends and makes rigorous the theory in this important area. Chapters 5 and 6 present work in the area of dynamic markets; the first on Linear-Quadratic Dynamic Markets, the second on Control of Dynamic Market Systems. Finally, Chapter 7 discusses the application area of electric power brokerage systems and proposes methods to improve their operation.

33435 **(PB—84-163880) Transportation energy management: fuel futures.** (Cabot Consulting Group, Washington, DC (USA)). Feb 1983. 74p. NTIS, PC A04/MF A01.

Sponsored in part by Urban Mass Transportation Administration, Washington, DC.

The report is designed to provide guidance on the use of fuel futures trading to lock in the price of fuel against volatile changes. While this is a new and different measure for a transit operator to take, the use of fuel futures seems to represent a rational and potentially beneficial action for transit operators concerned with rapid changes in fuel price. These measures have applicability in contingency planning to reduce price problems or provide for obtaining necessary fuel supplies in an energy emergency. The report describes the futures market operation in detail and addresses the feasibility of futures market trading in a straight-forward question and answer format. A glossary of market trading terminology is also included.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 32568, 32662, 33429, 34223, 34235, 34332, 34371, 34372

33436 **(CONF-8210265—) Proceedings: environmental government affairs seminar.** (Air Pollution Control Directorate (Canada)). 1982. 519p. NTIS (US Sales Only), PC A22/MF A01. Order Number DE84901096.

From Air Pollution Control Association and Federation of Associations on the Canadian Environment conference on environmental concerns of the 80'; Ottawa, Canada (12 Oct 1982).

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Presentations and summaries of comments are provided. Topics addressed during the seminar include: federal-provincial-industry-public interface concerning environmental problems in the 1980's; environmental impact assessment; transboundary pollution; hazardous substances; motor vehicles; and water - a manageable resource of the 80's.

33437 **(DOE/EV/10396—T1) Colorado's Joint Review Process for major energy and mineral resource development projects.** (Colorado Dept. of Natural Resources, Denver (USA)). Dec 1980. Contract FG03-80EV10396. 166p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013137.

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Colorado's Joint Review Process for Major Energy and Mineral Resource Development Projects (JRP) is an intergovernmental review process that coordinates government's review of major energy and mineral resource development projects. The JRP provides structure and certainty to an otherwise fragmented and unstable set of requirements, procedures, time frames, and interagency relationships. The JRP is a management system designed to coordinate regulatory and administrative reviews conducted by the three levels of government, thus expediting those review processes and improving the quality of project planning and review. This Manual provides a suggested comprehansive set of coordination procedures that should be used when conducting joint reviews of major energy or mineral resource development projects that are in early stages of project planning development. Although specific step-by-step coordination procedures are provided, nothing in this Manual should be considered mandatory or rigid. On the contrary, the Manual is a flexible guideline which can and should be modified or scaled-down to accommodate the unique characteristics of projects undergoing joint review.

33438 **(DOE/EV/10396—T3) Colorado Joint Review Process. Final technical report.** (Colorado Dept. of Natural Resources, Denver (USA)). Dec 1983. Contract FG03-80EV10396. 434p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE84013138.

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The Colorado Joint Review Process (CJRP) began operating in 1978 as an experiment in coordinated permitting for the Mount Emmons Molybdenum Mine and Mill proposed by AMAX, Inc. The CJRP has evolved from an administrative experiment to a statutorily authorized agency of Colorado State Government. This report is a compendium of materials describing how the CJRP has performed and how it might be enhanced over time. The materials contained in this volume have been organized into four primary sections. The first section includes materials which provide a general description of the CJRP. Articles, clippings, briefing memorandums, and the CJRP legislation provide a broad overview of what the CJRP is intended to accomplish and how it works. The second and third sections focus on how the CJRP has been received and how it might be improved. In these sections a variety of articles detailing the programs's strengths and weaknesses. The CJRP's applicability to other states is also addressed through the inclusion of several articles and papers. The final section is comprised of copies of the CJRP Projects' Updates. The updates provide a running commentary on each of the projects participating in the CJRP. Finally, a copy of the CJRP Manual has been included.

33439 **(FWS/OBS—84/08) Conducting a FERC environmental assessment: a case study and recommendations from the Terror Lake Project.** Olive, S.W.; Lamb, B.L. (Fish and Wildlife Service, Fort Collins, CO (USA). Western Energy and Land Use Team). Apr 1984. 68p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013134.

This paper is an account of the process that evolved during acquisition of the license to operate the Terror Lake hydroelectric power project under the auspices of the Federal Energy Regulatory Commission (FERC). The Commission is responsible for granting these licenses under the Federal Power Act (16 U.S.C. 792 et seq.). This act provides, in part, that FERC may condition a license to protect the public interest. The public interest in these cases has come to include both instream and terrestrial values. The Terror River is located on Kodiak Island in Alaska. The river is within the Kodiak National Wildlife Refuge; it supports excellent runs of several species of Pacific Salmon which are both commercially important and a prime source of nutrition for the Kodiak brown bear. The river is also a prime resource for generating electric power. One major concern in the negotiations was the impact of land disturbance and management practices on brown bear habitat - i.e., protection of the brown bear. Maintenance of the bears' habitat is the main purpose of the Kodiak National Wildlife Refuge. But, like many other projects, resolving the instream flow issue was of major importance in the issuance of the FERC license. This paper discusses the fish and wildlife questions, but concentrates on instream uses and how protection of these uses was decided. With this as a focus, the paper explains the FERC process, gives a history of the Terror Lake Project, and, ultimately, makes recommendations for improved management of controversies within the context of the FERC licensing procedures. 65 references.

33440 **(PB—84-158013) Human demographic impacts on fish and wildlife resources from energy development in rural western areas.** Thomas, M.G. (Midwest Research Inst., Kansas City, MO (USA)). Sep 1983. 375p. NTIS, PC A16/MF A01.

This workbook provides a mechanism for analysis of human demographic impacts on fish and wildlife due to large-scale energy developments in Western States. It focuses on impacts related to land use conversions and the accompanying reduction in quantity or quality of habitat and on impacts related to population growth and their demands or impacts on fish and wildlife resources.

33441 **(SOU—1983:20) Better environmental protection II. Final report from the Environmental protection commission.** (Jordbruksdepartementet, Stockholm (Sweden)). 1983. 230p. (In Swedish). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84751019.

The purpose of the Environmental Protection Commission was, in wiew of the experience gained from the application of the Environmental Protection Act to consider the legislative changes required to improve societs possibilities for intervening against and controlling environmentally hazardous activity. In its part report, better Environmental Protection I (Swedish Government Official Reports, SOU 1978:80) the Commission put forward its proposals on the system for pre-examination, supervision and sanction as well as right of appeal. In its part report, pollution of soil and ground water (Ministry of agriculture series, DsJo 1983:1), in additon to matters related to soil and ground water, the Commission dealt with the question of boarderline between areas of application of ML and water legislation and submitted proposals in these respects. In this final report, the Commission puts forward proposals in the following matters: Restoration and clean up of areas damaged as a result of environmentally hazardous activity; Environmental protection examination of public roads and streets; Environmental protection examination of airports; Noise from movable property; The standing of fishing interests in connection with examination in accordance with environmental protection legislation; The relationship between international agreements in the area of external environmental protection. In addition, certain other matters are reported that arose during the work of the Commission. Among these, special mention may be made of the matter of the legal treatment of environmental disturbances due to electrical installations.

2904 Natural Resources

REFER ALSO TO CITATION(S) 33440, 33466

33442 **(DOE/EV/10396—T2) Colorado permit directory for energy and mineral resource development.** (Colorado Dept. of Natural Resources, Denver (USA)). Dec 1983. Contract FG03-80EV10396. 432p. NTIS, PC A19/MF A01; GPO Dep. Order Number DE84013136.

This directory identifies the federal, state and local permits that may be required to explore, extract and process energy and mineral resources in Colorado as well as to develop major recreational sites in the state. All applicable federal, state and local permits are addressed. A review of county government environmental and land use enabling legislation is also provided. (ACR)

33443 **(PB—83-940806-2) USSR report: energy, No. 153, 12 July 1983-No. 169, 20 December 1983, JPRS tables of contents.** (Joint Publications Research Service, Arlington, VA (USA)). 1983. 45p. NTIS, PC A03.

Trans. of Russian Reports, 1983.

The report contains tables of contents of collections of translations of Russian articles on different sources of energy.

33444 **Energy and water development appropriations for 1985. Part 7. Testimony of members of congress and other interested individuals and organizations. Hearings before the Committee on Appropriations, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 1446p.

Part 7 of the hearing record covers the testimony of members of congress and other individuals and organizations wishing to comment on water and energy-related projects. The witnesses commented on the merits of projects in their states and districts. Of major concern were financing arrangements and strategies for cost sharing between the federal government and the private sector or state and local government. Witnesses spoke of the needs for water transport, irrigation, erosion and flood control, and other areas of concern.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 32539, 32687, 32789, 32948

33445 (CEA-N—2364) 1982. Progress report (no.19). (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1983. 251p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84751563.

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The research programs in solid state physics (physical metallurgy, semiconductors, magnetism, electronic structure), nuclear physics (heavy ion reactions, fission), chemistry and organic physical chemistry, and biology are described. Short scientific communications are reported and a list of the papers published by the department in 1982 is given.

33446 (GSI—82-15) GSI annual report 1981/82. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Dec 1982. 158p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751439.

This annual report contains short surveys about the scientific work performed by the named society, which concerns exotic nuclei, improvements of the UNILAC, and acceleration studies for the heavy ion induced inertial fusion, together with descriptions of the single fields of work concerning nuclear physics and nuclear chemistry with heavy ions, atomic physics with heavy ions, applications of heavy ions in biology and technology, as well accelerator developments. Furthermore lists of the scientific reports of 1981 and 1982 are added.

33447 (WAOENG—82-40) Current energy research and development in Washington State, 1982. (Washington State Energy Office, Olympia (USA)). Dec 1982. 103p. Washington State Energy Office, 400 E. Union, Olympia, WA 98504. Order Number TI84901172.

This directory is intended to acquaint researchers, policy makers, and citizens with recent activities in energy research, development, and demonstration projects. The information was collected by survey forms as printed in the WSEO newsletter, Volume 5, No. 4, June 1982; as sent to universities, utilities, research organizations, and contractors that did not send in the newsletter survey form; by computer search on the US Department of Energy's RECON data base in the Research-In-Progress file; by review throughout the year of directories, reports, newsletters, and newspapers for Washington projects; by follow-up telephone calls were made, as time permitted, to update the third edition; and with the inventory of Washington State Energy Office contract files.

33448 Management of Department of Energy programs and energy security. Hearing before the Subcommittee on Energy, Nuclear Proliferation, and Government Processes, United States Senate, Ninety-Eighth Congress, Second Session, January 24, 1984. Washington, DC; Government Printing Office (1984). 65p.

Energy Secretary Donald Paul Hodel was the principal witness at a hearing which reviewed the status of US energy security. Areas of progress included reaching six-month level of supply in the strategic petroleum reserve (SPR), a reduction in the level of dependency on imported oil, and an improved climate for energy conservation and technology investments. Hodel reviewed the current energy status, emphasizing the reduced vulnerability. Additional material submitted by Hodel for the record follows his testimony.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 32744, 33341, 34175

33449 (CNEN-NE—1.12) Qualification of organizations for independent technical supervision. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). Apr 1981. 7p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701907.

The requirements are established on trial for the qualification of an organization as an independent technical supervision organization in nuclear facilities, in activities related with quality assurance programs.

33450 (INIS-mf—8368) Energy and competition. Voices from industry. (Bundesverband der Deutschen Industrie e.V., Koeln (Germany, F.R.)). May 1982. 265p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780317.

The members of the Enquete Commission "Future Energy Policy" of the German Bundestag are introduced as well as the list of participants from industry and other organizations in the public heaving on 18 th December 1981. Then the catalogue of questions of the Enquete Commission is presented. The written answers of the 11 representatives of industry form the main part of the report. The minutes of the public hearing of the Enquete Commission 'Future Energy Policy' of the German Bundestag on Friday, 18th December 1981 on the topic of 'The Competitiveness of German economy in various energy supply structures' are presented. (UA).

33451 (INIS-mf—8905) Act of 18 March 1983 on Nuclear Third Party Liability (LRCN). (French Government, Paris). 18 Mar 1983. 12p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780322.

This new Act on nuclear third party liability maintains the two essential principles established by the law in force, namely those of causation and the channelling of liability on to the operator of a nuclear installation. On the other hand, the Act waives the principle of third party liability limited in amount and provides that the person liable must commit himself for an unlimited amount. Such liability is covered as follows: by private insurance up to 300 million francs; by the Confederation up to one thousand million francs over and above the amount covered by private insurance; by all the assets of the person liable. (NEA).

33452 (INIS-mf—8911) Decree No 82-864 of 4 October 1982 publishing the exchange of letters between France and Belgium dated 10 May 1982 concerning exchange of information on nuclear safety. (French Government, Paris). 10 Oct 1982. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780319.

Published in the French Official Gazette No. 237.

This Agreement provides, for purposes of nuclear safety, that France and Belgium will exchange information on their respective nuclear power plants and in particular, the Ardennes reactor (Chooz). (NEA).

33453 (INIS-mf—8913) Energy Act 1983 (Commencement No.1) Order 1983. (British Government, London). 23 May 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780323.

This Order brings into force on 1 June 1983 the provisions of the Energy Act 1983 relating to electricity generation and supply. The Order also brings into force on 1 September 1983 the provisions of the Act relating to the Electricity Consumers' Council and to nuclear installations. (NEA).

33454 (ORAU/IEA—84-4(M)) Options for the assurance of nuclear fuel supply. Spiewak, I. (Oak Ridge Associated Universities, Inc., TN (USA)). May 1984. Contract AC05-76OR00033. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012674.

Recent trends in the noncommunist countries have included a decrease in projected nuclear power production and an increase in uranium resources. As a result, any serious shortfall in low-cost uranium supply has been averted until after 2025 at the earliest. The need for the breeder reactor has been deferred, and other options for improving uranium utilization efficiency may become important. These options include exploitation of low-grade uranium resources, stripping of uranium from enrichment plant tailings, improved design of light water reactors, and recycle of fuel in thermal reactors. Utimately, breeders will be needed as part of an inexhaustible energy option.

33455 **(ORNL—5941) Protective actions as a factor in power reactor siting.** Gant, K.S.; Schweitzer, M. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013577.

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This report examines the relationship between a power reactor site and the ease of implementing protective actions (emergency measures a serious accident). Limiting populating density around a reactor lowers the number of people at risk but cannot assure that all protective actions are possible for those who reside near the reactor. While some protective measures can always be taken (i.e., expedient respiratory protection, sheltering) the ability to evacuate the area or find adequate shelter may depend on the characteristics of the area near the reactor site. Generic siting restrictions designed to identify and eliminate these site-specific constraints would be difficult to formulate. The authors suggest identifying possible impediments to protective actions at a proposed reactor site and addressing these problems in the emergency plans. 66 references, 6 figures, 8 tables.

33456 **(PB—84-183953) Nuclear power in an age of uncertainty.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Feb 1984. 303p. (OTA-E—216). NTIS, PC A14/MF A01.

This report assesses the future of nuclear power in the U.S. and how the technology and institutions might be changed to reduce the problems now besetting the nuclear option. The future of nuclear power poses a complex dilemma to policymakers. It has advantages that may prove crucial to the nation's energy system in the coming decades. OTA examined questions of demand growth, costs, regulation and public acceptance to evaluate how these factors affect nuclear power's future. Research directions which would improve conventional light water reactor technology and opportunities to develop other types of reactor concepts that might enhance safe and reliable operation are reviewed. The crucial role of utility management in constructing and operating nuclear powerplants is examined at length. The controversy about nuclear safety regulations is also analyzed and is presented with a review of current proposals for regulatory reform. The study discusses policy approaches that could assist a revival of nuclear options should that be a choice of Congress.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 32605, 32606

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 33035

2910 Conservation

REFER ALSO TO CITATION(S) 33583

33457 **(CONF-8311163—1-Summ.) Marketing concepts - sales methods for energy-efficient equipment on the heat market.** Dommann, D. (Hauptbereatungsstelle fuer Elektrizitaetsanwendung e.V., Hannover (Germany, F.R.). Aussenstelle). 1982. 2p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770331.

From North-German expert meeting on energy conservation in space heating - practical examples; Kiel, F.R. Germany (22 Nov 1983).

Published in summary form only.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 32660, 33431

33458 **(DOE/EI/10691—T1) Database of energy measures for short term energy forecast accuracy analysis.** (Native American Consultants, Washington, DC (USA)). 15 Jan 1982. Contract AC01-80EI10691. 148p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013463.

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Several data sets were collected, recorded and established as data files on an in-house computer. This report documents those data sets and their sources.

33459 **(DOE/EIA—0385) Synopsis of the Annual Energy Review and Outlook 1983.** (USDOE Energy Information Administration, Washington, DC). May 1984. 28p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. Order Number DE84012490.

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This booklet provides the reader with historical energy information and projections of the nation's energy future. It is a synopsis of two major reports produced by the Energy Information Administration (EIA), the Annual Energy Review 1983 and the Annual Energy Outlook 1983. For greater detail and explanation, the reader should consult these parent documents, which are centerpieces of the EIA's comprehensive energy data and analysis program. This year the booklet includes a matrix on the inside front cover that provides quick reference to energy subjects. We hope this booklet provides the reader with important highlights in a convenient and useful form. 44 tables.

33460 **(EKONO—164) World's energy future.** Hultin, S.O.; Ruttley, E. (Finnish Energy Economy Association, Helsinki). 1982. 24p. (CONF-8206248—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751038.

From 3. Latin-American oil show; Caracas, Venezuela (29 Jun 1982).

The report is a review of world's energy support including a short inventory of world's energy sources and energy needs.

33461 **(EPRI-EA—3507-Vol.1) Industrial process models of electricity demand. Volume 1. Summary report. Final report.** Pierce, B.L. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 32p. NTIS, PC A03/MF A01 - EPRI; GPO Dep. Order Number DE84012078.

This executive summary report describes the results of a research project on the future electricity demands of three US industries: aluminum, iron and steel, and paper. For each industry a base case scenario is developed, and then compared with different scenarios of demand for its end-use product, electricity and energy prices, and levels of investment in new energy-efficient scenarios. Linear programming models of each industry form the methodological basis for the project, and each industry is modeled in detail for the period 1980 to 2000.

33462 **(EPRI-EA—3507-Vol.2) Industrial process models of electricity demand. Volume 2. The pulp and paper industry. Final report.** Pierce, B.L.; Pilati, D.A.; Chang, J.; Sparrow, F.T. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 127p. NTIS, PC A07/MF A01 - EPRI; GPO Dep. Order Number DE84012080.

The National Center for Analysis of Energy Systems at Brookhaven National Laboratory has developed a process model of the US pulp and paper industry. The model is based on data from economic and engineering analyses of the major manufacturing processes in pulp and papermaking and includes Standard Industrial Classifications 2611, 2621, 2631, and 2661. Energy conserving alternatives to conventional technologies are included. The pulp and paper model is a dynamic and regional process optimization model incorporating the Bureau of Census defined regions of the Northeast, North Central, South and West. It is dynamic in that it analyzes a 25-year time horizon. Given fuel prices and product demand projections, the model selects modes of operation and energy con-

sumption characteristics that minimize the cost of meeting the projected demands. With a projected average annual growth rate of 3.3% for paper products, model results show a decline in the energy intensity of paper production and an increase in the demand for electricity.

33463 (ORNL/TM—9065) Liberian macroeconomy and simulation of sectoral energy demand: 1981-2000. Hill, L.J. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 99p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013665.

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The primary purpose of this report is to document the results of a research effort on end-use, sector energy demand in Liberia, West Africa over the 1981-2000 time horizon. The research was undertaken as one component of a much broader integrated energy assessment of Liberia. Other components of the assessment, however, focused on current energy supply and consumption together with future energy supply options for Liberia. This particular report is devoted exclusively to a discussion of Liberian energy demand. The methodology utilized to simulate Liberian sectoral energy demand over the period 1981-2000 involved the recursive interaction of a macroeconomic model and individual, econometrically-estimated sectoral demand equations. That is, given the projections for gross output in the Liberian economy from the macroeconomic model, sectoral energy demand was simulated. The individual energy demand equations were estimated on the basis of economic variables that are theorized to influence energy consumption in the respective sectors (e.g., price, output). The primary conclusion drawn from the analysis is that, besides being sensitive to changes in international economic activity, the demand for energy in Liberia over the 1981 to 2000 horizon is highly sensitive to internal production of its two primary exports: iron ore and rubber. More specifically, as characterized in the four scenarios, future growth in Liberian energy demand is contingent on the output of three companies: the Liberian American Swedish Mining Company, the Bong Mining Company, and the Firestone Rubber Company. Therefore, expansion of Liberia's energy supply capacity in the future should proceed cautiously. 16 references, 6 figures, 15 tables.

33464 (PB—84-163617) MEDEE-3: first results for Ireland and data collection. Final report. Killen, L. (Commission of the European Communities, Luxembourg). 1983. 112p. (EUR—8291-EN). NTIS, PC E06/MF E06.

Ireland's part in the energy research and development program of the E C, on the implementation of long-term energy demand models is described. After data collection for the MEDEE-3 model has been outlined, the data themselves are interpreted with regard to the socio-economic system, housing, and with regard to energy usage in the residential, tertiary, industrial, agricultural, and transport sectors. Lists of qualitative variables suitable for Irish case studies as well as relevant tabular functions are given. The last section of the report presents early results of the MEDEE-3 model for Ireland and forecasts of future energy demand.

33465 (PB—84-167337) Energy prospects for industry. Hartley, P.P.; Roberts, G.F.I.; Thomas, V.E.; Davies, D.; Crow, L.M. (Institute of Energy, London (UK)). 1983. 137p. NTIS, PC E10/MF E10.

Symposium held at University of Aston, Birmingham (England) on April 14, 1983.

Contents: Electricity today and tomorrow; Gas--supply prospects for the future; Petroleum based energy--the UK perspective; Future markets for coal; Flexibility--the key to Dunlop's energy strategy; Energy conservation in Alcan; Present and future energy patterns in Courtaulds PLC; New energy technology for the quarrying industry.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 32612, 32613, 32614, 32648, 32791, 33116, 33437, 33438, 33442, 33444, 33448, 34175

33466 (IFP—31-139) Economic aspects of the Chinese energy policy in the international background. Bourdeau, F. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). May 1983. 227p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84750799.

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A first part sets out the situation of the Chinese energy industry in the following sectors: coal, hydrocarbons, electricity, and other energy sources such as nuclear energy and the renevable energy sources. A second part deals with the structure and the evolution of the Chinese energy balance: supply and demand, modeling of energy consumption, and forecasting for 1990-2000. The third part is about the foreign aspects of the Chinese energy policy means of an international energy policy, the aims of the Chinese energy policy and its influence in the world.

33467 (INIS-mf—8909) Decree 82-784 of 10 September 1982 publishing the Agreement for co-operation in the nuclear field between the Government of the French Republic and the Government of the United Arab Emirates, signed at Abou Dhabi on 6 March 1980. (French Government, Paris). 17 Sep 1982. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780318.

Published in the French Official Gazette No. 217.

This Agreement between France and the United Arab Emirates came into force on the day of its signature. It provides that France will provide the necessary technical assistance to the United Arab Emirates for the preparation of a nuclear energy development programme, covering in particular, electricity generation and water desalination. The Agreement covers a period of three years and is automatically renewable unless otherwise decided. (NEA).

33468 (INIS-mf—8912) Decree No 82-842 of 29 September 1982 in implementation of Act No 76-599 of 7 July 1976 concerning prevention and repression of marine pollution due to dumping by ships and aircraft and accidental marine pollution. (French Government, Paris). 3 Oct 1982. 6p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780320.

Published in the French Official Gazette.

This detailed Decree provides for a system of permits for marine dumping of wastes and substances in determined areas in accordance with international conventions and the interests of national defense and telecommunications. (NEA).

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 32539, 32613, 32614, 32634, 32636, 32641, 32647, 32648, 32660, 32662, 32663, 32678, 32679, 32681, 32687, 33426

33469 (CSIRO-DET-TR—2) Exploring some Australian energy alternatives using MARKAL. Musgrove, A.R.D.; Stocks, K.J.; Essam, P.; Le, D.; Hoetzl, J.V. (Commonwealth Scientific and Industrial Research Organization, Sutherland (Australia). Lucas Heights Research Labs.). 1983. 127p. Commonwealth Scientific and Industrial Research Organisation, Lucas Heights Research Labs., Sutherland, Australia.

MARKAL is a linear programming model for the optimisation of the technologies associated with energy supply and demand within the complete energy system of a country as it evolves over a given time period. It was developed in the course of a project sponsored by the International Energy Agency, which was carried out at two main centres: Kernforschungsanlage, Juelich, FRG, and Brookhaven National Laboratory, Upton, New York, USA. Australia's participation in the Project has enabled the latest version of MARKAL to be installed on the computer at the Lucas Heights Research Laboratories together with the necessary supporting software programs.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 32791

2960 Electric Power

REFER ALSO TO CITATION(S) 33038, 33052, 33116, 33583, 33585

33470 **(DOE/EIA—0226(84/02)) Electric Power Monthly, February 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). May 1984. 43p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. Order Number DE84011591.

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The Electric Power Monthly (EPM) includes comprehensive information about the electric utility industry in the United States. Detailed, plant-level data are contained in the Electric Power Quarterly. The summarized data contained in this report are presented for the use of a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. Data for 1983 presented herein are revised and final; 1983 data published prior to April 1984 were preliminary.

33471 **(DOE/EIA—0226(84/03)) Electric power monthly, March 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jun 1984. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013370.

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The Electric Power Monthly (EPM) includes comprehensive information about the electric utility industry in the United States. Detailed, plant-level data are contained in the Electric Power Quarterly. The summarized data contained in this report are presented for the use of a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. The data presented in this report were collected and published by the Energy Information Administration (EIA), U.S. Department of Energy, to fulfill its data collection and dissemination responsibilities as specifed in the Federal Energy Administration. Data for 1983 presented are revised and final; 1983 data published prior to April 1984 were preliminary.

33472 **(DOE/ET/29008—1) Optimal stochastic operations scheduling.** (ALPHATECH, Inc., Burlington, MA (USA)). Nov 1983. Contract AC01-79ET29008. 104p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84014168.

This report presents the results of the third year of a 3-year project to develop improved methods for solving large-scale operations scheduling problems. A principal objective of this project has been to develop optimization procedures which will faithfully represent the operational constraints present in an electric power system. This report describes a new algorithm which gives optimal solutions while requiring less execution time than suboptimal methods.

33473 **(DOE/ET/29362—1) Contribution to power system state estimation and transient stability analysis.** (ESCA Corp., Bellevue, WA (USA)). Feb 1984. Contract AC01-79ET29362. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014170.

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A well-established trend in the power system is the increase in control area interconnections and interdependent operating strategies. A more recent, but growing trend is a concomitant increase in information exchange. The former increases the dependence of one area's security upon the operating conditions of other areas, while the latter allows security assessment methods to more effectively account for these dependencies. The need to evolve state estimation technology, as these trends continue to evolve the nature of the problem, is the principle motivation for the direction taken in this area of development. A secondary focus of this research is on a particular aspect of the third security assessment activity. This is the assessment of a power system's capability to maintain synchronism following a major disturbance. Transient stability assessment today is not performed in the real time operating environment, because existing analysis methods are far too computationally intensive to be used. The significant level of manual interaction and judgement required is also a factor. In this area research on an uncertain, alternative assessment methodology, as opposed to existing method evolution, is motivated by the need to advance transient stability assessment towards real time operation.

33474 **(DOE/ET/29367—1) Operation of the large interconnected power system by decision and control in emergencies.** (Washington Univ., St. Louis, MO (USA). School of Engineering and Applied Science). Sep 1983. Contract AC01-79ET29367. 219p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84014165.

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Techniques for the computer aided operation and control of the large interconnected power system in its Normal, Alert, Emergency and Restoration conditions were in the process of development at Washington University under consecutive sponsorship by NSF-RANN, ERDA and DOE for the last 15 years. At this point at least a broad based consistent foundation for the computer aided operation and control of the large power system is accomplished. Since this body of results is now scattered in some 45 separate publications it seems timely to discuss the overall accomplishments in a summary fashion as is done here. These results differ from the state of art of the control centers on the power system in being more consistent and much more complete (e.g. computer aided emergency control or restoration as defined here are not state of art) more up to date in parts (e.g. automatic generation control has 1950's servomechanism implementation in the state of art) and most of all by being a mathematically and computationally sound large system approach taylored to the operating needs and basic structure of the system itself, not to the imposition of existing solution or computation techniques.

33475 **(DOE/RA/50418—1) Information flow in event-driven large-scale systems.** (ALPHATECH, Inc., Burlington, MA (USA)). Mar 1984. Contract AC01-80RA50418. 572p. NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE84014162.

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To bring into sharp focus the issues of real-time communication and coordination of distributed estimation and control agents, we concentrated our investigations on the class of event-driven stochastic systems. These systems are hybrid-state dynamical systems, whose state description consists of a control and operation related to emergency control, stability analysis, restorative control and security assessment. Thus the study of event-driven systems represented an important area for basic research in the design of distributed estimation and control algorithms for power systems operation. By focusing on event-driven systems, our research was able to examine explicitly the design and performance of different organizational structures, with variations in information aggregation strategies, event-directed communications and event-directed distributed control.

33476 **(DOE/RC/11334—T1) Electric utility coordination in the VACAR region: potential for savings 1983-2000.** (Ransom and Casazza, Inc., Washington, DC (USA)). 01 Sep 1983. Contract AC39-81RC11334. 301p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84013936.

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The study described here was made to determine the potential benefits and costs of increased pooling and coordination activities among the utilities in the VACAR region. The Virginia-Carolina area (VACAR) utilities are interconnected and currently coordinate their operations to some degree. This study used the system and procedures as-planned by the VACAR utilities and existing institutional arrangements as a basis for comparison with alternative coordination scenarios. The study included the development of new computer modeling programs for analysis of the VACAR systems. The techniques included representation of the systems external to VACAR and an improved representation of transmission con-

straints. The analysis was separated into two phases. The first phase studies covered the 1983 to 1990 period for which expansion plans of the utilities are substantially underway and cannot be changed without considerable penalty. This phase focused on the potential of improved coordination of operations. The second phase of the analysis included the 1991 to 2000 period in which little commitment to expansion plans has been made. Focus of this phase was the potential of improved coordination of planning.

33477 **(DOE/RG/10063—T1) Relationships between consumers' attitudes and knowledge and the effect of time-of-use rate structures on electricity consumption: North Carolina.** (Michigan State Univ., East Lansing (USA). Center for Evaluation and Assessment). Sep 1981. Contract FG01-79RG10063. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013293.

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The North Carolina Time-of-Use (TOU) Rate Demonstration Project examined the effects of various TOU rate schedules on residential consumers' electrical usage, including both total usage and temporal patterns of electricity consumption. This report summarizes the findings of a series of secondary analyses of the data derived from this demonstration project. These secondary analyses focused on the effects of consumers' knowledge of, and attitudes toward, the TOU rate structure to which they were assigned on both total electricity usage and temporal patterns of consumption. These analyses were made possible by the provision of an extensive exit interview, which was administered to all participants at the completion of the one year demonstration project. In addition, data on electricity usage, the dependent variable for these analyses, was collected throughout the duration of the demonstration project. After describing the general features of the demonstration project, this report presents the findings of secondary analyses undertaken to determine participants' knowledge of the TOU rate structures to which they were assigned, their attitudes toward TOU rate structures, and the relationships between these attitude and knowledge measures and electricity consumption. Findings are presented separately for the Carolina Power and Light Company (CP and L) and the Blue Ridge Municipal Electric Company.

33478 **(DOE/RG/10063—T3) Effects of consumers' attitudes and knowledge on the acceptance and utilization of time-of-use rates: Edmond, Oklahoma. Final report.** Crano, W.D.; Messe, L.A.; Buldain, R.W.; Johnson, C.D. (Michigan State Univ., East Lansing (USA). Center for Evaluation and Assessment). Aug 1980. Contract FG01-79RG10063. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013297.

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The Edmond, Oklahoma, Time-of-use (TOU) Rate Demonstration Project was concerned with the effects of various TOU rate schedules on consumers' electrical usage. Both total usage and temporal patterns of electric consumption were studied in this demonstration. This report summarizes the results of a series of secondary analyses of data based on exit and followup surveys. These analyses were focused principally on the effects of consumers' knowledge of, and attitudes toward, the TOU rate structure to which they were assigned, and the impact of these reactions on their electric usage, relative to that of a comparable group of consumers.

33479 **(DOE/RG/10063—T4) Analysis of the psychometric properties and correlates of the central Vermont Public Service Corporation: 1980 survey of time-of-use and non-time-of-use electric customers.** Buldain, R.W.; Crano, W.D.; Hymes, R.W.; Messe, L.A. (Michigan State Univ., East Lansing (USA). Center for Evaluation and Assessment). Dec 1980. Contract FG01-79RG10063. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013292.

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This report presents the results of a comprehensive analysis of a survey of electric utility customers served by the Central Vermont Public Service Corporation (CVPSC). This survey assessed the attitudes, behavioral reports, and household characteristics of a selected sample of residential customers of CVPSC. The present report summarizes and discusses the Center for Evaluation and Assessment's analyses of the psychometric properties of the customer survey and the relationships found between customer attitudes, reported behaviors, demographic characteristics, and residential features of the sample.

33480 **(DOE/RG/10063—T5) Critical review of Elrick and Lavidge's customer acceptance surveys.** Crano, W.D.; Messe, L.A. (Michigan State Univ., East Lansing (USA). Center for Evaluation and Assessment). 19 May 1980. Contract FG01-79RG10063. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013294.

In the mid-1970's, the marketing research firm of Elrick and Lavidge, Inc. conducted a series of consumer attitude surveys with the goal of determining the degree of customer acceptance of a number of innovative electric rate schedules. An overview of customer attitudes and acceptance of various forms of existing and proposed electric utility rate schedules and tariff provisions. The report is a summary of the review of the major documents that Elrick and Lavidge produced for this study. Our report focuses on the technical quality of the work performed, and the extent to which the research that was conducted fulfilled the mission.

33481 **(DOE/RG/10063—T6) Cognitive factors that influence consumers' responses to innovative rate structures.** Crano, W.D. (Michigan State Univ., East Lansing (USA)). 1980. Contract FG01-79RG10063. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013295.

This paper discusses the assumptions that have been made with regard to the price signal in the context of research on time-dependent electric rate structures, and demonstrates the impact on consumer behavior when these assumptions are not met. It summarizes the results of an investigation of consumers' understanding of the pricing manipulations employed in a DOE-sponsored time-of-use (TOU) demonstration experiment conducted in Edmond, Oklahoma. In addition, the impact of various TOU rate structures on consumers' electric consumption as a function of their understanding of the price signal is inspected. Finally, the factors that appear to influence such understanding is also discussed.

33482 **(NP—4770266) Public electric power industry in North-Rhine Westfalia, 1970-1981.** (Landesamt fuer Datenverarbeitung und Statistik Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). Apr 1983. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770266.

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Within the framework of the total energy supply situation the supply of electric power has become of increased importance within the past years. Particularly for a highly industrialized and densely populated country like North-Rhine Westphalia the development of the public electric power industry is thus of large interest. In the present publication data on the electric energy gained from the public supply network in NRW have been compiled for the first time. The user is now presented with some figures which are able to give a survey of the situation and development of the public electric power industry of NRW in the period 1970-1981. Not only technical and physical data are provided but also important conditions and backgrounds specific for this energy sector.

33483 **(PB—84-147198) Principles for electric power policy: appendices.** (Technology Futures, Inc., Austin, TX (USA)). 1983. 382p. NTIS, PC A17/MF A01.

See also PB84-147206.

An overview of the research design and methodology is provided. The tasks involved in conducting the assessment are examined, including: selecting research participants, developing a range of critical factor projections, conducting four workshops, preparing workshop materials, and writing the final report. Comments solicited from participants in an expert opinion survey are included on subjects such as capital costs of coal and nuclear electric capacity, lead times for central electrical power plants, and composition of future U.S. coal consumption. Survey participants are listed and their affiliations are noted. Two scenarios used as discussion vehicles at the assessment workshop held in January 1982 are considered. Opening remarks delivered at the workshops are provided and concerns raised by a panel of expert consultants are listed.

33484 **(PB—84-175041) Bibliography of the Maryland Power Plant Siting Program, Fifth Edition.** Magette, T. (Maryland Dept. of Natural Resources, Annapolis (USA). Power Plant Siting Program). Jan 1984. 68p. NTIS, PC A04/MF A01.

See also PB83-179051.

The Maryland Power Plant Siting Act of 1971 established the Power Plant Siting Program to insure that demands for electric power would be met in a timely manner at a reasonable cost while assuring that the associated environmental impact would be acceptable. The scope of the Program extends to estimating the impact of proposed new generating facilities, evaluating the acceptability of proposed transmission line routes, assessing the impact of existing generating facilities, acquiring sites for utilities unable to find a suitable site for generation, and investigating generic issues related to power plant site evaluation and associated environmental and land use considerations. This bibliography is a compilation of all the studies performed for and/or by the Power Plant Siting Program since its inception.

33485 **(SOL—84-1) Will planned electric capacity limit economic growth.** McAllister, P.H.; Stone, J.C. (Stanford Univ., CA (USA). Systems Optimization Lab.). Mar 1984. Contract AT03-76ER72018. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84011867.

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In the face of strong economic and political disincentives, many electric utilities in the US are pursuing very cautious capacity expansion plans. The natural question is whether a sustained period of limited electric capacity growth can effectively inhibit potential economic growth, both in aggregate and in specific sectors of the economy. In this study, we use a significantly enhanced version of the Stanford PILOT economic model to investigate the economic consequences of an electric capacity shortfall. We developed six scenarios of future economic growth in the US, under a variety of assumptions on electric capacity growth rates and on foreign trade conditions. Analysis of scenario results suggests that a continuation of current trends in utility capacity expansion could produce a generation shortfall of about 1.1 tkWh in year 2000, relative to a scenario in which utility capacity expands to meet potential economic demand. This 27% shortfall produces a loss in economic output of about $100 billion per year by 2000. The loss in output does not extend to all economic sectors, however. Domestic production in the paper, steel, non-ferrous metals, and stone, clay, and glass sectors is reduced, while output in the trade, communications, machinery, and transportation equipment sectors is actually increased. The economic losses are most severe in scenarios with high imported oil prices or in which a political rationing scheme is used to allocate electricity shortfalls.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 32678, 32679, 33459, 33465

33486 **(ESC-WR—83-26) Improvement of the energy efficiency: opportunities for industry.** Over, J.A. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Nov 1983. 28p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The ratio between energy costs and all other costs may differ considerably for the different industrial activities, and with them, the future attitudes and possibilities for improvement of energy efficiency. Since 1977 the energy efficiency has been improved by 10%, but probably this will increase much more. Several possibilities and recommendations are given, e.g. the so-called Energy Centers, combined power/heat generating units for users in industrial concentrations. Other opportunities for industry are measures to improve energy conservation by the whole population which can give employment and profits for trade and industry.

33487 **(ORNL—6050) Transportation Energy Data Book: Edition 7.** Holcomb, M.C.; Koshy, S. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 182p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013766.

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This document is the seventh edition of the Transportation Energy Data Book, a statistical compendium compiled and published by Oak Ridge National Laboratory (ORNL) under contract with the Office of Vehicle and Engine Research and Development in the Department of Energy (DOE). The data book was designed for use as a desk-top reference, presenting statistics that characterize transportation activity and data on other factors that affect transportation energy use. The publication displays relevant statistical data in the form of tables and graphs. Each of the major transportation modes (highway, air, water, rail, and pipeline) is treated in separate chapters or sections. Aggregate energy use and energy supply data for all modes are presented in Chapter 1. The highway mode, which accounted for 73.3% of total transportation energy use in 1981, is dealt with in Chapter 2. Topics covered in this chapter include vehicle stock characteristics, fuel efficiency, fleet automobiles, buses, and trucks. Chapter 3 presents data on each of the nonhighway modes: air, water, pipeline, and rail, respectively. Chapter 4 profiles the motor vehicle industry with historical trends in vehicle and engine characteristics. Economic indicators related to the industry are also presented.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 32789, 32948, 33463

33488 **(NE—1983-8) Consulting about wood and peat as fuels.** Grundberg, O.; Johansson, H.; Knudsen, F. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Mar 1983. 80p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751008.

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The energy flow in the County of Vaesternorrland is considerable. The main components of the flow are electrical energy, fuels based on wood, and oil. The consumption of the tree kinds of energy is about 600 thousand tons of oil equivalents (t oe). The project work was focused on fields where the Provinces own solid fuels were supposed to replace oil used for heating and in industrial processes. The work of the project group was primarly aimed at three target groups: wood-fuel and peat producers, energy consumers, equipment manufacturers. The experience of the project, is as follows: The technical conditions of rapid development of the production and offer of wood fuel (wood and sawmill waste) are good. The conditions of peat are different. The supplies are moderately large and tradition as for production is none. Yet three heavy projects are in progress. On the other hand efforts are needed to increase the consumption of domestic fuels and thus the demand. It is the opinion of the project group that the advisory service of the community concerning solid domestic fuels could and should be more vigorous. Advisory service must be combined with the demonstration of running plants where the positive results are convincing.

33489 **(PB—84-171941) Environmental effects of multi-fuel stoves and fireplaces. Where there's smoke there's fire.** Okken, P.A. (Milieukundig Studiecentrum Groningen (Netherlands)). Nov 1982. 118p. (In Dutch). (PUB—8). NTIS, PC E06/MF E01.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

33490 **(ECN—140) Fossil fuel fired closed cycle MHD power generating experiments.** Flinsenberg, H.J. (Stichting Energieonderzoek Centrum Nederland, Petten). Dec 1983. 182p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750911.

A study has been made of the generator performance during a series of power runs of the 5 MWth blow-down facility, which has been built in order to achieve realistic closed cycle MHD power generating experiments from a fossil fuel operation for

longer test times. The analysis is directed towards an understanding of the overall generator performance in relation with the experimentally observed discharge structures. To study the plasma composition, discharge structures and electrical generator performance, a number of diagnostic tools have been developed. Recombination radiation measurements, absorption measurements, line intensity measurements, high speed photography, mass-spectrometry, laser Mie scattering measurements and both high frequency resolved and time averaged electrical measurements are performed. The experiments with the blow-down facility up to now have shown the generation of a substantial electric power of 362 kWe. A constricted discharge structure (in the form of streamers) is always observed in these experiments, having a substantial degree of ionization of the seed material and a large current density (up to 10/sup 6/ A/m2). A streamer model has been developed to analyse the flow field in- and outside the discharge structure. The results show the existence of a pronounced vortex flow inside the streamer. From this the solid body concept of the streamer is introduced in a new generator model, describing the major interaction terms of the streamer and the background gas. A reasonable agreement has been found between the predicted generator performance and the measured generator performance in the first half of the generator. A substantial deviation from the theory has been found in the experiment for the last part of the generator due to Hall shorting phenomena that occur in this part of the generator.

33491 **A survey of recent work on explosive-driven magnetic flux compression generators.** Caird, R.S.; Erickson, D.J.; Fowler, C.M.; Freeman, B.L.; Garn, W.B. (Los Alamos Scientific Laboratory, Los Alamos, NM 87545). pp 1-18 of Energy storage, compression, and switching. Vol. 2. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corporation (1983). (CONF-751247—).

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter describes and compares the characteristics of spiral, coaxial, strip, plate and cylindrical implosion systems. Discusses the use of switching, fuses and transformers for sharpening or impedance-matching the output pulse of the generators. Outlines some of the areas of application of the generators. Points out that much of the recent work at Los Alamos has been directed toward the development of the plate generator, which consists of a transmission line with explosive slabs on the flat surfaces. The plates may be parallel or at an angle to each other. A plane detonation front in the explosive allows a large area of conductor to be driven simultaneously, resulting in very high power and current outputs. Discusses results of tests on the plate generator, which is well suited to driving low impedance plasma devices.

33492 **Flux compression generators as plasma compression sources.** Fowler, C.M.; Caird, R.S.; Erickson, D.J.; Freeman, B.L.; Garn, W.B.; Thomas, D.B. (Los Alamos Scientific Laboratory, Los Alamos, NM). pp 19-42 of Energy storage, compression, and switching. Vol. 2. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—).

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter surveys applications where explosive-driven magnetic flux compression generators have been or can be used to directly power devices that produce dense plasmas. Discusses representative examples that are specific to the theta pinch, the plasma gun, the dense plasma focus and the Z pinch. The examples are used to illustrate the high energy and power capabilities of explosive generators. An application employing a rocket-borne, generator-powered plasma gun emphasizes the size and weight potential of flux compression power supplies. Provides recent results from a local effort to drive a dense plasma focus. Discusses imploding liners in the context of both the theta and Z pinches.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 32775

3005 Fuel Cells

REFER ALSO TO CITATION(S) 33372, 33380, 33607, 33609, 33610, 33738

33493 **(CONF-840853—3) Molten carbonate fuel cell cathode development.** Smith, J.L.; Kaun, T.D.; Minh, N.Q.; VanDeventer, E.H.; Mrazek, F.C.; Pierce, R.D. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012101.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

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From the results obtained so far, Li_2MnO_3 and $LiFeO_2$ look promising as cathode materials for the MCFC. The materials have low solubility in the molten electrolyte and do not migrate under cell operating conditions. However, further studies of their resistivity is required before they can be fully assessed. Zinc oxide does not appear to be a good cathode material candidate due to its high solubility and its incorporation into the $LiAlO_2$ matrix, although the conductivity of doped ZnO is low enough for its application as a cathode.

33494 **(DOE/FE/15078—1613) Molten carbonate fuel cell performance model update. Quarterly report, October 1983-December 1983.** Wilemski, G.; Kemp, N.H. (Physical Sciences, Inc., Andover, MA (USA)). Mar 1984. Contract AC21-81FE15078. 59p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84012932.

This report contains a detailed description of a new porous electrode model, termed the heterogeneous film model, which is intended to be a reasonable depiction of ERC's ceramic coated Ni anodes and to serve as a first approximation to GE's and ANL's Ni/Cr anodes. In this model the electrode is pictured as a highly crosslinked three-dimensional network of Ni or Ni/Cr filaments. The Ni or Ni/Cr is coated by a porous layer of ceramic or chromite. Most of the fine-scale porosity of the electrode is found in the layer. Consequently most of the electrolyte resides in this layer which then forms a heterogeneous film on the Ni or Ni/Cr surface. The film coated Ni or Ni/Cr network is idealized as a random packing of short cylinders. The theoretical development of the model includes mathematical descriptions of ionic conduction, liquid phase diffusion through the heterogeneous film, and electrode kinetics on the Ni or Ni/Cr surface. Arguments based on conservation of porosity are used to express the geometric parameters of the model in terms of a few observable properties of the electrode. This report also contains a detailed mathematical analysis of the development of vertical concentration gradients in the gas flow channels. A general solution is presented and applied to the cathode and anode flow channels. Application to the anode requires some modifications due to the occurrence of the water gas shift reaction on the channel hardware surfaces.

33495 **(DOE/NASA/0201—4) Evaluation of gas-cooled pressurized phosphoric acid fuel cells for electric utility power generation. Final technical report.** Farooque, M. (Energy Research Corp., Danbury, CT (USA)). Sep 1983. Contract AI21-80ET17088. 81p. (NASA-CR—168298). NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013886.

Gas cooling is a more reliable, less expensive and a more simple alternative to conventional liquid cooling for heat removal from the phosphoric acid fuel cell (PAFC). The feasibility of gas-cooling has already been demonstrated in atmospheric pressure stacks. This report presents theoretical and experimental investigations of gas-cooling for pressurized PAFC. Two approaches to gas cooling, Distributed Gas-Cooling (DIGAS) and Separated Gas-Cooling (SCG) were considered, and a theoretical comparison on the basis of cell performance indicated SGC to be superior to DIGAS. The feasibility of SGC was experimentally demonstrated

by operating a 45-cell stack for 700 hours at pressure, and determining thermal response and the effect of other related parameters.

33496 **(PB—84-179779) Improved acid electrolytes for fuel cells. Annual report Jan-Dec 83.** Shreeve, J.M. (Idaho Univ., Moscow (USA). Dept. of Chemistry). Jan 1984. 18p. NTIS, PC A02/MF A01.

The overall project objective is to design and/or synthesize and submit for testing fluorine-containing sulfur (VI) and/or phosphorus (V) compounds for possible use as electrolytes in synthetic fuel cells.

33497 **Predictive testing for fuel cells.** Patel, D.N.; Maru, H.C.; Farooque, M.; Ware, C.H. (Energy Research Corp., Danbury, CT). *Proceedings - Electrochemical Society;* **81-82**: 39-44(1981). (CONF-811013—Vol.81-82-Absts). Contract AC05-79ET15381.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33498 **Improvements in phosphoric acid fuel cell performance.** Kelley, D.A.; Maru, H.C.; Christner, L.G. (Energy Research Corp., Danbury, CT). *Proceedings - Electrochemical Society;* **81-82**: 243-245(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33499 **Corrosion of 316L stainless steel in environments simulating molten carbonate fuel cell conditions.** Shores, D.A. (General Electric Corp. Research and Development, Schenectady, NY). *Proceedings - Electrochemical Society;* **81-82**: 212-213(1981). (CONF-811013—Vol.81-82-Absts). Contract AC02-80ET17019.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33500 **Development of corrosion resistant phosphoric acid fuel cell components.** Christner, L.; Ahmad, J.; Farooque, M. (Energy Research Corp., Danbury, CT). *Proceedings - Electrochemical Society;* **81-82**: 216-217(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33501 **Selection of carbon as electrode material.** Kordesch, K.; Tomantschger, K.; McBreen, J.; Olender, H.; Srinivasan, S. (Technical Univ., Graz, Austria). *Proceedings - Electrochemical Society;* **81-82**: 219-221(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33502 **Modification of rotating ring-disc electrode kinetics to obtain rate constants of intermediate steps in oxygen reduction.** Hsueh, K.L.; Chin, D.T.; Srinivasan, S. (Los Alamos National Lab., NM). *Proceedings - Electrochemical Society;* **81-82**: 254-256(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33503 **Structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea.** Gonzalez, E.R.; Hsueh, K.L.; Srinivasan, S. (Los Alamos National Lab., NM). *Proceedings - Electrochemical Society;* **81-82**: 257-259(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33504 **Reduced platinum sintering on modified carbon supports.** Remick, R.J.; Mazumder, M.M. (Inst. of Gas Technology, Chicago, IL). *Proceedings - Electrochemical Society;* **81-82**: 263-264(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33505 **Adsorption of trifluoromethanesulfonate anions on mercury electrodes.** Gonzalez, E.R.; Srinivasan, S. (Los Alamos National Lab., NM). *Proceedings - Electrochemical Society;* **81-82**: 1429-1431(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

33506 **(DOE/BP—237) Long-range conservation projection.** (USDOE Bonneville Power Administration, Portland, OR. Div. of Planning and Evaluation). May 1984. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013681.

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Conservation planning analysis and assumptions and conservation program and sector acquisition levels are presented. Each of the consuming sectors - residential, commercial, industrial, and irrigation - are described in some detail. Energy consumption data and conservation potential estimates are presented. The acquisition strategy describes each subsector in terms of end uses impacted, typical measures, measure life, costs, and market characteristics. The sector strategy is compared to the Council plan. Bonneville Power Administration's plans for developing and refining knowledge in each sector are described. Each sector development plan focuses on BPA's objectives to improve knowledge in its estimates of technical and market potential for conservation, environmental impacts and possible mitigation strategies, new technologies, and alternative financing.

33507 **(ESC-WR—83-24) Investment in energy conservation. A review of possibilities.** Boonekamp, P.G.M.; Goumans, J.J.J.M.; Kram, T.; van der Veen, J.C.; van Wees, F.G.H. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Oct 1983. 182p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

This report contains the conclusions of a study of possible measures which can lead to the reduction of energy costs via investments in energy conservation and energy conversion technologies. The following end-users are investigated: agriculture, buildings, residential buildings, services, transportation and industry.

3201 Buildings

REFER ALSO TO CITATION(S) 32940, 32942, 32943, 33507, 33761, 34153

33508 **(AD-A—137230/9) Evaluation of shelter ventilation by model tests, option 1 - below ground shelters. Final report Sep 82-Dec 83.** Krishnakumar, C.K.; Koh, J.B.; Fields, S.F.; Henninger, R.H. (GARD, Inc., Niles, IL (USA)). Dec 1983. 60p. NTIS, PC A04/MF A01.

Update to report dated Mar 83, AD-A126765. Includes summary dated Sep 83.

Wind-induced ventilation rates that could be achieved in a 100-man below-ground shelter with simple designs of passive flow enhancement devices (FEDs) were estimated by scale model tests in a low-speed wind tunnel. Air volume flow rates through the model were determined by using bubble flow tracers and motion photography. Test results indicate that adequate ventilation can be achieved in the type of shelter considered by the use of FEDs even at relatively low wind speeds. The study also generated guidelines for the relatively low speeds. The study also generated guidelines for the design of FEDs and their placement around stairway openings. In addition, estimates of reductions in ventilation rates due to an obstruction upstream of the windward FED and due to a decrease in the area of wall openings were made.

33509 **(BMFT-FB-T—84-067) Development and testing of a diesel-powered compression heat pump for domestic central heating systems.** Coutelle, R.; Danninger, W.; Gaiser, P.; Nguyen, N.V.; Scheid, E.; Schulte, H.; Eibl, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 254p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84751774.

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A diesel-powered air-to-water heat pump with engine-speed control for domestic central heating systems has been developed and tested. A monovalent operation and high flow-temperature of approx. 70°C have been realized. Piston-type compressors and a screw-type compressor have been examined. Based on the experimental results, a computer program was compiled to simulate the operation of the heat pump during an entire heating period. By modifying the combustion process of the diesel engine, the soot and NOsub(x)-emissions were reduced up to 50% and the HC-emissions up to 15% of the corresponding initial values. Some prototypes have been installed in domestic central heating systems for long-time tests.

33510 **(CONF-840801—9) Raman spectroscopy measurements of flame quenching in a duct-type crevice.** Fairchild, P.W.; Fleeter, R.D.; Fendell, F.E. (TRW Space and Technology Group, Redondo Beach, CA (USA). Engineering Sciences Lab.). 1984. Contract AC04-78ET13329. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009328.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

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Flame/wall interactions in a duct-type crevice (simulated by two parallel walls) have been investigated by making Raman scattering measurements of the spatial temperature profile for a range of wall separations and flame stoichiometry. Experiments using both cold (isothermal) and hot (adiabatic) walls in an atmospheric pressure premixed propane/air flame show that as the wall separation is reduced opposite quench layers begin to interact. The effect is more severe for the leaner fuel mixtures where the flame speed has been reduced. Results with a hot wall show the reduced quench layer thickness that is associated with the flame front position moving closer to the wall.

33511 **(CONF-840801—10) Laminar flame propagation/quench for a parallel-wall duct.** Carrier, G.F.; Fendell, F.E.; Feldman, P.S. (Harvard Univ., Cambridge, MA (USA); TRW Defense and Space Systems Group, Redondo Beach, CA (USA). Engineering Sciences Lab.). 1984. Contract AC04-78ET13329. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009773.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

Steady laminar isobaric two-dimensional propagation of a fuel-lean large-activation-temperature premixed flame between plane parallel (isothermal noncatalytic) walls is examined theoretically. A Shvab-Zeldovich engineering-type formulation, with a treatment of convective transport of species and heat in the manner of Oseen, is integrated numerically by quasilinearization/alternating-direction-implicit techniques. Of particular interest in this transcendentally nonlinear elliptical (convective-diffusive-reactive) boundary-value problem is how the flame speed (an eigenvalue) decreases as the well separation decreases, for different wall temperatures. At a finite wall separation the quenching distance is achieved, such that the flame speed goes abruptly to zero; this critical quenching distance is found to be smaller for hotter walls. This investigation seeks to lend credibility of principle to one possible strategy for reducing the level of unburned-hydrocarbon species exhausted from Otto-cycle-type cylinders. The primary source for hydrocarbon emissions is now generally acknowledged to be the failure of flame to propagate into the narrow piston crevice owing to heat loss to cold walls. Higher wall temperature at the piston crown and rings would seem to abet flame propagation and assist burn-up during the combustion event; also, persistent fuel vapor would be discharged at higher temperature into the hot, oxygen-rich bulk cylinder contents during the power-stroke expansion.

33512 **(DOE/CS/60038—4) Saving money through energy conservation in manufactured housing.** (Indiana Dept. of Commerce, Indianapolis (USA)). 1984. Contract FG45-76CS60038. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012709.

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Things to look for in buying a new manufactured home are discussed. Site orientation is discussed and energy saving tips for heating, cooling, hot water heating, kitchen, dishwasher, laundry, and lighting are presented. A glossary is included. (MHR)

33513 **(DOE/IR/08323—T1) Energy cost reduction for retail florists.** (Department of Energy, Washington, DC (USA)). 15 Dec 1977. Contract AI01-76IR08323. 60p. Society of American Florists, 901 N. Washington St., Alexandria, VA 22314. Order Number TI84009552.

This handbook shows retail florists how to recognize and act on energy waste in lighting, heating, refrigeration, delivery, and greenhouse operations. The following are included: a summary of savings, energy management, greenhouse, assessing energy needs, economic projections, and record monthly use and expenditures. Twenty-one methods of saving money in the retail florist business are presented. (MHR)

33514 **(DOE/OR/20890—2) Test procedures for rating residential heating and cooling absorption equipment.** Weber, B.; Radermacher, R.; Didion, D. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Apr 1984. Contract AI05-81OR20890;AC05-84OR21400. 78p. (NBSIR—84-2867). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013413.

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Test and rating procedures are presented for gas-fired absorption devices operating in either the heating or cooling modes. These procedures are designed to include the effects of part-load and cyclic operation, variations in outdoor temperature, and frost formation during the heating mode. Both air-source and ground water source absorption heat pumps are considered, as well as air cooled and ground water cooled air conditioners and water chillers. A calculation procedure is presented for estimating the heating and cooling seasonal performance and cost of operation of residential water chillers, air conditioners, and heat pump units.

33515 **(ISI-B—8-82) Present situation and energy consumption of space HVAC systems in the Federal Republic of Germany.** (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung). 1982. 39p. (In German). (FLT—3/1/80/82). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751777.

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The present study deals with the availability of data which will help to estimate the present number of complete heating, ventilation and air conditioning systems and air conditioners and their energy consumption. The types of data will have a decisive influence on the choice of method and the comprehensiveness of the preliminary assessment carried out here. Details on the systems in operation are given on the basis of the input as installed because of the wide variations in dimensions of the systems.

33516 **(KTM/E-D—19) Follow-up of an air heating system functioning by air circulation in the rooms of a block of flats.** (Ministry of Trade and Industry, Helsinki (Finland). Energy Dept.). 1983. 102p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751037.

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Results from an experimental research work in a block of flats with warm air heating system are presented. The energy consumption, performance of heating and ventilation, and indoor climate were studied with data collecting system, manual measurements and interviews. The test building is situated in Lappeenranta in South-eastern Finland. It is constructed of concrete elements, the floors are partly the partition walls are built of concrete hollow blocks, which are also utilized as supply air ducts. The building is connected in district heating network. The experimental character

of the building was taken into account since early design stage. The follow-up period ended in July 1982, until the results are analyzed. In evaluating the warm-air system, special attention is paid to following aspects: how the components work, especially together, is the system too complicated, is it easy to use, is it worth developing and where development is needed. All observed problems in performance were analyzed. The results from the project can be summarized as follows: the construction and installations succeeded as a whole. The supply air ductwork, including the joints between hollow blocks, is airtight, and its dynamic performance is very good also in summer. The air flows into and from various rooms were well adjusted. Also the building envelope is airtight enough. The utilization of free heat sources was, however, lower than calculated, because of many technical problems in the building, which mostly were not caused by the warm air heating system itself. The system can be considered as worth applying and developing, both technically and economically. The various aspects concerning the use and maintenance must be taken into account to quarantee the total performance of the system.

33517 **(LBL—17196) High-intensity discharge (HID) solid-state ballast program: engineering development report. Phase II.** Carlson, R.S. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013882.

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A high frequency (28 to 31°K Hz) electronic current source (ballast) designed to drive a 200 watt 100 volt sodium vapor gas discharge lamp is described. A resonant switching power amplifier system utilizing a novel constant power feedback loop is employed to maintain the lamp input power constant within two percent via changes due to lamp aging etc. The lamp input power and therefore the light output is adjustable from 50 to 100 percent of rated power. A input (electronic filter) inverter, changes the 277 volts alternating voltage input to a regulated direct current (DC) voltage used to power the output stage. The inverter reflects, a essentially unity power factor load to the power input source at all times.

33518 **(LBL—17444) CONTROLITE 1.0: program documentation.** (Lawrence Berkeley Lab., CA (USA)). Mar 1984. Contract AC03-76SF00098. 87p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013884.

This computer program, CONTROLITE, provides an unbiased mathematical model from which comparisons can be made, on an economic basis only, of how different lighting control systems perform. The program has the option of calculating daylighting values as input. Calculations can also be done on simple control sytems which do not respond to daylighting. For purposes of allowing for the calculating of daylighting values, program CONTROLITE is augmented with an accurate yet quick subprogram QUICKLITE. QUICKLITE employs what is known as the daylight factor method for calculation of daylighting values. The major components of the program are discussed in this documentation and several examples are included to explain how to run the program. Appendix C contains a report of the scope of work performed to bring CONTROLITE to its present form.

33519 **(LBL—17476) Skylight energy performance and design optimization.** Arasteh, D.; Johnson, R.; Selkowitz, S.; Sullivan, R. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 8p. (EEB-W—84-03; CONF-840610—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013389.

From Windows in building design and maintenance conference; Gothenburg, Sweden (13 Jun 1984).

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Proper skylight utilization can significantly lower energy requirements and peak electrical loads for space conditioning and lighting in commercial buildings. In this study we systematically explore the energy effects of skylight systems in a prototypical office building and examine the savings from daylighting. The DOE-2.1B energy analysis computer program with its newly incorporated daylighting algorithms was used to generate more than 2000 parametric simulations for seven US climates. The parameters varied include skylight-to-roof ratio, shading coefficient, visible transmittance, skylight well light loss, electric lighting power density, roof heat transfer coefficient, and type of electric lighting control. For specific climates we identify roof/skylight characteristics that minimize total energy or peak electrical load requirements.

33520 **(NBSIR—84-2816) Laboratory evaluation of the steady-state and part load performance of absorption type heating and cooling equipment.** Radermacher, R.; McLinden, M.; Klein, S.; Didion, D. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Mar 1984. Contract AI05-81OR20890;AC05-84OR21400. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013414.

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In this investigation, an absorption water chiller and absorption heat pump were extensively tested under steady-state and cyclic operating condtions. Since the tests were performed on two different units, one for a cooling only and one for a heating only application, the report is set up in two parts discussing the results of the testing of each unit separately. In addition to the black box tests of the units, the causes for the degradation during part load operation were investigated in more detail using the absorption chiller and determining that migration of the fluids during the off periods are a major contribution to the degradation. Furthermore, the influence of various heating water temperatures and flow rates and the sensitivity to the charge was more closely investigated employing the absorption heat pump.

33521 **(NP—4770329) Influence of the interior design of a room on the room temperature curve and the heating energy.** Ruefenacht, A. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1981. 178p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770329.

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This thesis contains a numerical method for the calculation of layer and surface temperature of any coated building component with any temperature curves for both sides. It is shown how interior heat sources and insolation of the surface can be included into the calculation. The effects of variations of the influence of the outer temperature on the energy household of buildings are of special interest; the main interest however is concentrated on the inner components.

33522 **(NP—4901204) Evaluation of the Missouri Division of Energy's project conserve class B energy audit project.** Barnett, D.R. (Missouri Dept. of Natural Resources, Jefferson City (USA). Div. of Energy). 25 Apr 1984. 27p. NTIS, PC A03/MF A01. Order Number DE84901204.

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A posttest control group telephone survey was used to document the results of the Division's Project Conserve Energy Audit Project. The survey found no attributable energy savings. Several contributing factors as to why not were hypothetized. Most likely cause was seen as the shotgun audit distribution method used by the Division of Energy which did not address those homeowners most in need of an energy audit.

33523 **(ORNL/CON—159) Development of advanced thermal insulation for appliances.** McElroy, D.L.; Yarbrough, D.W.; Copeland, G.L.; Weaver, F.J.; Graves, R.S.; Tong, T.W.; Fine, H.A. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 71p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013132.

The development of thermal insulation with an apparent thermal conductivity of less than 0.0072 W/(m K) (equivalent to a thermal resistance per inch thickness of 20 ft^2 h °F/Btu) is discussed. A theoretical model that includes radiative and conductive heat transfer shows that the target thermal resistance can be attained by combinations of very fine powders and reduced pressures. Apparent thermal conductivities of fine powders were measured with three apparatuses. A linear heat flow measurement demonstrated apparent thermal conductivities as low as 0.0087 W/(m K) (R per inch = 16.6 ft^2 h °F/Btu) for evacuated panels containing fine particles. Radial heat flow measurements on fine powders as a function of temperature, gas pressure, and bed density showed that

apparent thermal conductivities below the target value can be achieved with pressures below 100 Pa. The radial heat flow measurements also demonstrated the existence of an optimum mass fraction solid in the powder insulations.

33524 **(ORNL/Sub—81-7762/301) Simulation and performance of a system using an R-12/R-114 refrigerant mixture.** Stoecker, W.F.; McCarthy, C.I. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). May 1984. Contract AC05-84OR21400. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013568.

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The objective of this combined analytical and experimental study is to determine energy conservation possibilities through the use of a refrigerant mixture in a refrigerator or heat pump. The system is one with two evaporators that are operated at different temperatures levels, and the basic approach was to maintain constant refrigeration loads and temperatures throughout a series of tests wherein the composition of the refrigeration mixture was altered. The experimental measurements consisted of the determination of temperatures and pressures throughout the system, energy flow rates and compressor power, and boiling and condensing heat-transfer coefficients as the fraction of R-114 in the mixture varied from 0.0 to 0.6. In order to maintain the fixed refrigeration capacity in the two evaporator and decreased through the condenser as is expected for a refrigerant mixture. System simulation predicted an 8 percent saving in compressor power for an optimum 68 percent R-114 mixture (of R-12/R-114) in comparison to R-12 alone. The experimental results at this stage show about a 2 percent reduction in power in the range 10 to 15 percent R-114 in the mixture.

33525 **(PB—84-160175) Investigation into the control of a domestic gas fired boiler using mathematical models. Technical memo.** Marchant, S.J.; James, R.W.; Osborne, W.C. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Jan 1980. 64p. (TM—74). NTIS, PC E05/MF E05.

A mathematical model describing the dynamic and steady state behavior of a small domestic, high thermal capacity, gas fired boiler has been derived. In addition, equations have been added to the model to represent the behavior of a lounge, with its heating system, and a domestic hot water cylinder. The model has been used to investigate the influence of the control system on system efficiency and energy consumption for part load operation of the boiler.

33526 **(PB—84-160183) Dynamic analysis of an experimental rig incorporating a domestic gas fired boiler. Technical memo.** Marchant, S.J.; James, R.W.; Osborne, W.C. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Oct 1979. 47p. (TM—68). NTIS, PC E04/MF E04.

An experimental rig has been designed and developed to investigate the dynamic and steady state behavior of a small central heating gas fired boiler. A mathematical model of the complete system has been derived and is being used in conjunction with the rig to investigate the transient behavior of heating systems and their control.

33527 **(PB—84-160563) Integrated heating system; technical and economic case.** Russell, F.M. (Rutherford Appleton Lab., Chilton (UK)). Dec 1983. 17p. (RL—83-121). NTIS, PC E03/MF E03.

The results of recent work directed at optimizing a thermal store and heat pump combination for space heating purposes are reported. A novel feature is the use of an integral thermal energy management system. (Copyright (c) Science and Engineering Council 1983.)

33528 **(PB—84-160845) Dynamic behaviour of domestic boilers and their domestic hot water and central heating systems. Technical memo.** Marchant, S.J.; James, R.W.; Osborne, W.C. (Polytechnic of the South Bank, London (UK). Inst. of Environmental Science and Technology). Mar 1979. 51p. (TM—65). NTIS, PC E05/MF E05.

The purpose of this survey is to review the results of investigations into the relative merits of low and high thermal capacity boilers and their thermal performance when integrated within wet central heating systems. The efficiency of domestic hot water production out of the space heating season has also been considered.

33529 **(PB—84-162817) Analysis of a building space heating system and its control strategy.** Florez, J.; Barney, G.C. (Manchester Univ. Inst. of Science and Technology (UK). Control Systems Centre). Jun 1983. 23p. NTIS, PC E03/MF E03.

Based on the observed temperature profile distribution, the idea of an automatically balanced heating system is proposed and the installation of solenoid valves is suggested. These will divide the building heating system into different zones which can operate independently of each other. A new control strategy based on self-tuning controllers is developed which will reduce the commissioning time normally needed to match the controller to the thermal characteristics of the building and heating system.

33530 **(PB—84-163088) Economies in the use of energy obtained by using decorative textiles. Final report.** Vancolen, P. (Centre Scientifique et Technique de l'Industrie Textile Belge (CENTEXBEL), Brussels). 1980. 18p. (In Flemish). NTIS, PC E03/MF E03.

The principle ways in which heat is lost from a room are outlined and a general summary is given as to how the use of textile wall and floor coverings can effect energy savings. A more rigorous study is then given showing how the thermal resistance of partitions can be improved by the use of insulation materials. Also dealt with is heat loss at windows and how window sills and curtains can be utilized to reduce this energy dissipation.

33531 **(PB—84-167428) Approximate thermal analysis for a regenerative air heater.** Atthey, D.R. (Central Electricity Generating Board, Southampton (England). Technology Planning and Research Div.). 1982. 25p. (TL—383). NTIS, PC E03/MF E03.

This report describes an approximate thermal analysis of a regenerative air heater. The approximation used relies on the fact that the dimensionless periods are not too large, a condition which is made more precise in the report, and which is true for all CEGB power station air heaters. The method gives time averaged fluid outlet temperatures which are equivalent to those deduced from Hausen's analysis. The method also gives the variation of fluid and heat exchange element temperatures with position and time, and is generalized to cover the case of a heater fitted with two sets of heat transfer elements with significantly different heat transfer properties.

33532 **(PB—84-171412) Comparison of hot water preparation in electrical store boilers and combination boilers with oil and gas firing.** (Elektrowirtschaft, Zurich (Switzerland)). 1980. 206p. (In Swedish). NTIS, PC E11/MF E11.

A comparison is made between hot water preparation in electrical storage boilers and combination boilers with oil and gas firing, emphasizing the onesided dependency of Swiss power supply on petroleum and the type of oil consumption for heating, stressing the fact that oil should be used preferably in the pharmaceutics industry and plastics chemistry.

33533 **(PB—84-171537) Gas-fired duplex free-piston Stirling refrigerator. Annual report Nov 82-Oct 83.** Urieli, I. (Sunpower, Inc., Athens, OH (USA)). Dec 1983. 28p. NTIS, PC A03/MF A01.

The duplex free-piston Stirling refrigerator is a potentially high efficiency, high reliability device which is ideally suited to the home appliance field. In particular as a gas-fired refrigerator. It has significant advantages over other equivalent devices freedom from halogenated hydrocarbons, extremely low temperatures available at a high efficiency, and simple burner system control. This report describes the design and development of a portable working demonstration gas-fired duplex Stirling refrigeration unit in order to demonstrate the technology to potential manufacturers. A necessary factor in the development of a Stirling prime mover system is the

use of a sophisticated computer aided development code. This requires continued interaction between the theoretical analysis and practical testing and evaluation. The technical approach was designed around this requirement. A universal test rig was developed in order to separately test and evaluate the major subunits, subsequently enabling a smooth system integration phase and a verified baseline for future system scaling.

33534 **(PB—84-171586) Electricity-driven heat pump.** (Elektrowirtschaft, Zurich (Switzerland)). 1980. 61p. (In Swedish). NTIS, PC E05/MF E05.

Whereas the physical foundations of the construction of heat pump heating systems have been known for a long time, the development of heat pumps is still in progress. The condensers for smaller facilities have been standardized and are built in serial construction, the remaining components need to be adapted in most cases to special situations, thus making facilities more expensive. An obstacle to the manufacture of standardized heat pump facilities is mainly the diversity of heat sources, their different quality and yields. Purchase of a serially constructed heat pump would be desirable for small-scale construction, connectable to the heat source and the heat distribution system, as it is possible for oil firing and with electrical resistance heating systems. Development trends go in this direction. For larger-scale facilities, some more time will elapse before this goal is reached.

33535 **(PB—84-171602) Electrical room heating.** (Elektrowirtschaft, Zurich (Switzerland)). 1982. 88p. (In Swedish). NTIS, PC E06/MF E06.

This SKEW room heating report deals chiefly with use of existing free power capacities for room heating. The following energy-policy criteria must here be noted: Part of night energy must be reserved for operating pump storage power plants so that they can carry out their real task of covering peak requirements. Another part of night power must be reserved for hot water preparation to reduce the uneconomic petroleum use in this sector. These criteria, together with the anticipated needs of the other users, provide the remaining power capacities for electrical room heating. These capacities must be used rationally and logically, one condition being a general reduction in energy consumption for room heating which can be achieved by changing consumer habits, better building insulation and use of more efficient heating systems.

33536 **(PB—84-174457) Commercial cooking equipment improvement. Annual report Jul 82-Jun 83.** Himmel, R.L. (American Gas Association Labs., Cleveland, OH). Sep 1983. 49p. NTIS, PC A03/MF A01.

See also PB84-100924.

This report describes the efforts of a project aimed at improving the thermal efficiency of gas-fired commercial cooking equipment, specifically the development of a commercial open top section employing powered burners and the development of means for applying pulse combustion burners to closed top portions of commercial ranges and griddles. Three approaches to designing powered burners were designed and constructed which have efficiency improvements of up to 50 percent over contemporary open burner systems. Two of the designs will have turndown capabilities while the third system is designed to be a single input auxiliary system. Preliminary results indicate that the time to heat water can be cut in half. A pulse combustion fry top or griddle was designed, constructed and successfully operated in the pulse mode. It is unique in its geometry and volume. Further efforts are necessary to obtain the temperature distribution required for consistent cooking operations.

33537 **(PB—84-175033) Development of a pulse combustion space heater. Annual report Mar 82-May 83.** Thrasher, W.H. (American Gas Association Labs., Cleveland, OH). 30 Jun 1983. 72p. NTIS, PC A04/MF A01.

A prototype model of a low-cost, high efficiency pulse combustion space heater was developed that operated satisfactorily and had a steady state thermal efficiency approaching 92 percent. The unit operates in a condensing mode and heat transfer occurrs from a combustion chamber, exhaust pipe and a secondary heat exchanger. The design operates at 18,000 Btu/hr, utilizes outdoor air for combustion and vents the flue products directly outdoors in a manner similar to conventional direct vent appliances. An oval-shaped burner is selected as being most promising from an operational standpoint and the ability to physically fit within the confines of a contemporary sized or smaller cabinet. Further development work leading to the construction of advanced prototypes is planned. A field test of ten units to characterize the operational characteristics and user acceptance of the appliance is scheduled for the 1983-84 heating season. The space heater will benefit both the consumer and the gas industry by providing a space heating appliance that has efficiencies approaching those of unvented gaseous and liquid fueled heaters without the disadvantages of venting combustion products into the conditioned area.

33538 **(PB—84-179761) Efficiency and emissions improvement of gas-fired space heaters. Task 1. Efficiency improvement of vented heaters. Final report 1 Feb-31 Jul 83.** Zawacki, T.S.; Cole, J.T.; Huang, V.M.S.; Banasiuk, H.; Macriss, R.A. (Institute of Gas Technology, Chicago, IL (USA)). Mar 1984. 39p. NTIS, PC A03/MF A01.

This report assesses various methods of improving the steady state and annual fuel utilization efficiencies (AFUE) of gas-fired vented space heaters.

33539 **(PB—84-179878) Characterization of emissions from a fluidized-bed wood chip home heating furnace. Final report Apr 82-May 83.** Truesdale, R.S. (Research Triangle Inst., Research Triangle Park, NC (USA)). Mar 1984. 74p. (RTI—1914-70-01F). NTIS, PC A04/MF A01.

The report gives results of measurements of emissions from a residential wood-chip combustor, operated in both a fluidized-bed and cyclone-fired mode, and their comparison with those from a conventional woodstove and industrial wood-fired boilers. In general, the combustion efficiency of the fluidized-bed and cyclone-fired wood-chip burner is higher than that of conventional woodstoves. Concomitant with this increase in efficiency is a decrease in most emissions. For the fluidized-bed tests, significant reductions of total hydrocarbons and CO were observed, compared to woodstove emissions. The cyclone test showed PAH levels far below those of conventional woodstoves, approaching levels measured in industrial wood-fired boilers. A baghouse, installed during two fluidized-bed tests, was extremely effective in reducing both particulate and PAH emissions. Method 5 samples from above the fluid bed suggest that appreciable PAH is formed in the upper region of the furnace or in the watertube heat exchangers. In general, the cyclone-fired mode was more effective in reducing emissions from residential wood combustion than the fluidized-bed mode.

33540 **(PNL-SA—12234) Buildings innovative concepts.** Lee, V.E. (ed.). (Pacific Northwest Lab., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 184p. (CONF-8405106—). NTIS, PC A09/MF A01; GPO Dep. Order Number DE84013410.

From Building innovative concepts fair; Arlington, VA, USA (23 May 1984).

In 1982 the Office of Energy Systems Research within the US Department of Energy (DOE) initiated the Innovative Concepts Program to identify immature concepts having the potential for saving substantial amounts of energy and to provide seed money for a preliminary investigation of their technical feasibility. This report provides information on the 12 innovative buildings concepts selected for further examination. The approach used in this project assumes that (a) good concepts come from experienced, knowledgeable investigators, (b) innovators frequently generate more good ideas than can be used within their own organizations, and (c) ideas are frequently generated in an organization unable to appropriate the benefits of further development. Therefore, other industrial organizations or federal agencies may be interested in providing financial support for further development of such concepts. This project is an experiment in a continuing program to harvest creative, novel approaches to saving energy. A competitive solicitation was used to screen proposed concepts and subsequently to provide seed money for a limited number of concepts. Concepts were sought (a) combining the functions of two or more materials, (b) providing dynamic control of the functions of building materials, or (c) overcoming barriers to widespread use of current energy-saving technology in buildings. The seed money approach funded a

preliminary investigation of the technical feasibility of each concept. The innovative concepts presented in this report and briefly summarized below are organized under three major headings: daylighting, building materials, and building systems. Each chapter heading lists the subcontracting organization responsible for the work and their principal investigator(s) and author(s), and Appendix A lists their addresses.

33541 **(SBI-R—149) Collective heat inspection of groups of owner-occupied houses.** Als, J.K.; Andersen, N.E.; Jensen, O.; Kjelstrup, S.; Moerk, P. (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). 1983. 80p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751002.

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So far heat inspection and energy-saving measures in owner-occupied houses have almost exclusively been carried out separately in individual houses and for individual owners. The present report describes a method which may be used for collective performance of heat inspection and energy-saving measures in large groups of relatively uniform owner-occupied houses. The procedure described comprises the following phases: 1. Contact between energy consultant and houseowners' association. 2. First meeting of houseowners' association where owners who want to join the scheme will notify this. 3. Heat inspection and submission of report to owners. 4. Second meeting of houseowners' association,Description of the proposed energy-saving measures.

33542 **(SBI-R—151) Laboratory testing of joints between windows and highly insulated cavity walls. Investigations of tightness against rain and wind.** Kjaer, A. (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). Oct 1983. 36p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751003.

EFP-80.

In the Danish energy research programme, 1EFP 80, a number of laboratory tests have been carried out on models of highly insulated cavity brick walls in order to study rain- and wind tightness of the joints between windows and such walls. Tests have been carried out with joints tightened only with a rain barrier as well as with joints according to the two stage joint principle. In the exterior part of the joint has in both cases been used a mortar, and expanding gasket, an EPDM-profile and wooden battens. Further an experiment has been carried out on a plastic window, where mastic was used as well in the exterior as the interior part of the joint. The findings were that a two-stage joint gives the best performance as well regarding air tightness as rain tightness. Further the experiments have shown that a window frame should have a depth of at least 90 mm in order to design a joint between window and wall, which is satisfactory as well regarding thermal insulation as resistance to rain and wind.

33543 **(UCRL—90252) Experimental and modeling study of engine knock.** Smith, J.R.; Green, R.M.; Westbrook, C.K.; Pitz, W.J. (Sandia National Labs., Livermore, CA (USA); Lawrence Livermore National Lab., CA (USA)). 19 Jan 1984. Contract AC04-76DP00789;W-7405-ENG-48. 23p. (CONF-840801—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006134.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

Raman and emission spectroscopy, laser induced fluorescence, schlieren photography, and gas sampling have been used in a single cylinder, spark ignition engine to study preflame conditions and reactions that lead to knock. The intake manifold temperature and pressure were used to control the fraction of fuel autoigniting in a 5.1 compression ratio engine. N-butane, isobutane, and propane were studied, but only n-butane and isobutane were found to knock under the range of achievable inlet conditions. Detailed kinetics modeling predicts the trends in the autoignition delay times. Preflame reactions involving OH and CH radicals producing carbon monoxide, formaldehyde, and faint blue light were observed, however, the inclusion of a low temperature reaction scheme had little effect on calculated ignition delays.

3202 Transportation

REFER ALSO TO CITATION(S) 33507, 33600

33544 **(DOT-I—83-02) Transportation energy contingency planning, quantifying the need for transit actions.** Boyle, D.K. (New York State Dept. of Transportation, Albany (USA)). Jan 1983. 109p. NTIS, PC A06/MF A01. Order Number TI84901216.

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This report provides a simple, rapid method for anticipating or reacting to a peak-hour transit capacity problem brought about by an energy shortfall. The first step is determining when peak-hour capacity should be increased on a given route. This is done through use of the Capacity Problem Index (CPI) developed here. A worksheet is provided for calculating the CPI, and the results lead the transit operator directly to recommendations for what should be done to increase peak-hour capacity. Three packages of recommendations are provided for use depending on the severity of the peak-hour capacity problem. The body of the report serves as a manual for transit operators wishing either to plan for various energy scenarios or to take action in a crisis. The appendices contain a more detailed analysis, including sections on the evaluation of peak-hour capacity-expending options, the responses of 45 transit operators to the 1979 energy shortfall, and the development of the Capacity Problem Index.

33545 **(DOT-I—83-20) Scenario planning: energy considerations in the long range urban transportation planning process.** (Regional Planning Council, Baltimore, MD (USA)). May 1983. Contract AI01-81CS90103. 253p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84013590.

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This report documents an 18-month study funded by the Department of Energy and the Department of Transportation which aimed at incorporating energy conservation in regional planning framework. The study was a prototype application of scenario analysis in the public planning context. The scenario technique is a comprehensive approach which allows consideration of the interaction of energy issues with transportation as well as other planning concerns such as land use, technological change, and economic development. The project created several hypothetical futures typified by varying levels of oil availability, and constructed sets of policy responses designed to deal with the problems typifying those future conditions. It is concluded that unique insights were gained which would not have emerged in the course of more conventional planning activity; still, because so many new issues were raised, follow-up efforts to fully incorporate the findings and methodology into the continuing planning process are crucial to the ultimate success of the project.

33546 **(LA-UR—84-1490) Refueling considerations for liquid-hydrogen fueled vehicles.** Stewart, W.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 32p. (CONF-841219—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012623.

From 5. intersociety cryogenics symposium; New Orlenas, LA, USA (9 Dec 1984).

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Liquid hydrogen is a possible fuel for transportation applications in the future. Such use of liquid hydrogen will require a refueling station analogous to today's service station for gasoline and diesel fuels. The cryogenic nature of liquid hydrogen and concerns for safety indicate the desirability of a refueling system that is automated as completely as possible and incorporates sufficient redundancy for safe and reliable operation. A refueling system designed on the basis of previous experience with liquid hydrogen transfer systems has been developed, and a preliminary system has been built and tested. A series of tests was conducted to determine the extent of the liquid hydrogen losses during a refueling operation and to determine optimum transfer procedures and conditions.

33547 **(PB—84-150341) Energy conservation and cost saving related to highway routine maintenance: data collection and analysis of fuel consumption. Report for Jan-Dec 82.** Sharaf, E.A.; Sinha, K.C.; Yoder, E.J. (Purdue Univ., Lafayette, IN (USA). Joint Highway Research Project). 15 Dec 1982. 114p. NTIS, PC A06/MF A01.

Sponsored in part by Indiana Dept. of Highways, Indianapolis.

This report presents the results of a study aimed at the identification of fuel consumption by various types of equipment used in highway routine maintenance activities in the State of Indiana. Two basic groups of results are discussed: (1) fuel consumption rates for all possible activity-equipment combinations as well as total fuel consumed per production unit of each activity; and (2) the effect of factors such as location (subdistrict), highway type, and season on fuel consumption. The first group of results will be of direct use to the Indiana Department of Highways (IDOH) in the planning of the annual maintenance program, while the second group will be useful in evaluating the actual fuel use (in the field) by different management units (subdistricts).

33548 **(PB—84-163245) Assessment of the San Diego light rail system. Technical report (final).** McGean, T.J.; Haussmann, J.G.; Lee, M.T.; Watzich, J.; Bamberg, W. (Lea (N.D.) and Associates, Inc., Washington, DC (USA)). Nov 1983. 219p. (NDL—41-VI). NTIS, PC A10/MF A01.

Prepared in cooperation with Gannett Fleming Transportation Engineers, Inc., Harrisburg, PA.

This report documents an assessment of the San Diego Light Rail Transit (LRT) system which began revenue service on July 26, 1981. The objectives of this assessment are: to document early planning leading to the decision to build, essentially without federal funding; to document the system that was built entirely with limited state and local funds; to assess the performance and operation of this system; to assess the applicability to other cities of this low-budget approach for providing rail transit service; and to provide urban planners with information to assist them in determining whether this type transit can meet their specific needs. This report is limited to an assessment of the original first phase system which began operation in July 1981.

33549 **(PB—84-178383) Passenger train equipment review report. Volume 2. Propulsion system components and future train energy consumption. Final report Feb-May 81.** (Unified Industries, Inc., Springfield, VA (USA)). May 1981. 304p. NTIS, PC A14/MF A01.

See also Volume 1, PB84-178375, and Volume 3, PB84-178391. Prepared in cooperation with Battelle Columbus Labs., OH., Carnegie-Mellon Univ., Pittsburgh, PA. Transportation Research Inst., and Marchetti (J. W.), Inc., Natick, MA.

Early in 1977, the Federal Railroad Administration, Office of Research and Development, initiated the Improved Passenger Equipment Evaluation Program (IPEEP), which was designed as a detailed systematic review of advanced passenger trains and equipment throughout the world that could possibly be used in the United States. During the course of this program, the members of the IPEEP Train System Review Team prepared 24 technical papers, in addition to the basic set of IPEEP reports covering baseline data and individual train reviews and a separate report on train performance methodology. This volume of six papers covers traction motor drives, modern slip detection and control systems for electric locomotives and multiple-unit cars, onboard high-voltage switchgear for electric locomotives and multiple-unit cars, high-voltage protection and switching control for Northeast Corridor vehicles, pantographs, and the energy consumption of future passenger trains.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 32562, 33400, 33507, 33622

33550 **(AD-A—140085/2) Field demonstration of three-phase Wanlass motors. Final report Aug 81-Apr 83.** Dann, G. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Jan 1984. 97p. (NCEL-TN—1686). NTIS, PC A05/MF A01.

Electric motors are major part of the load at Naval shore facilities. The Naval Civil Engineering Laboratory (NCEL) investigated the Wanlass motor as a means of reducing power consumption, reducing current flow, and improving power factor, as compared to standard motors. NCEL surveyed the literature on single-phase and poly-phase Wanlass motors and tested poly-phase Wanlass motors. Efficiency, current, power factor, load sharing, temperature rise, vibration and noise, torque-speed, and reliability were judged. A reduction in current flow and a corresponding improvement in power factor can be expected with the Wanlass rewind. A small improvement in efficiency - a reduction in power consumption - is possible but not certain. It was recommended that Wanlass rewinds not be purchased on the basis of energy savings or power factor improvement.

33551 **(BMFT-FB-T—84-003) Quick and complete recovery of the precious metals of low-grade sweeps and scrap.** Jung, V. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jan 1984. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751419.

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The increasing industrialization caused a continuous rise in the demand for precious metals, so that the natural resources were no longer sufficient; new recycling processes had to be developed. The special aim of the original project was the treatment of Ag- and Au-bearing materials in order to recover the precious metals (blast furnace-, converter-process). By comparison the treatment of materials with relatively high content of Pt-group metals (PGM) was much more complicated. So the new project had to develop new techniques to improve the recovery by collecting the PGM in copper (blast furnace). The PGM-bearing copper bullions were then treated in a converter for separating the impurities and to collect them in a special slag, and then build a copper litharge for leaching; a copper melt was left containing the PGM. The cast anodes were then submitted to an electrorefining-process. The efficiency of the recovery of the PGM in the whole process could be raised to 90%.

33552 **(CONF-840804—1) Investigation of thermal stability of fluorinol-85 and 2-methylpyridine/water as Rankine Cycle Power Systems working fluids.** Jain, M.L.; Demirgian, J.; Hillis, D.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006420.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

Results of the experimental investigation to date, indicate that Fluorinol-85 could be utilized in Organic Rankine Cycle Power Systems (ORCPS) to a maximum cycle temperature of 550°F without any discernable decomposition over an extended period of time. However, at 575°F, Fluorinol-85 could possibly decompose between 1 and 3% per year depending upon system design considerations. 2-methyl-pyridine/water could have possibly less than a 2% annual decomposition rate at 600°F maximum cycle temperature.

33553 **(DOE/CS/40297—T1) Factory demonstration energy efficiency of powered hand tools. Final report.** (Varigas Research, Inc., Timonium, MD (USA)). [nd]. Contract AC03-79CS40297. 201p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84004840.

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The results of a field demonstration program to determine the relative energy efficiencies of different types of powered hand tools used under actual operating conditions are presented. Three manufacturing plants in different geographical locations, dealing primarily in three diverse operations, were equipped with alternate air and electric tool systems. These systems included energy converters, distribution systems, matched tools and all energy measurement and reporting instrumentation. Under normal, day-to-day, operating conditions the different tool systems were employed for periods of time sufficient to collect statistically reliable data on energy consumption. The basic conclusion of this work is that, in the applications studied, dedicated pneumatic tool systems will average

more than thirteen times as much energy as high cycle electric tool systems powered by rotary frequency converters while performing the same tasks. Conventional plant air systems may use, by comparison, more power per unit work achieved. Moreover, when chosen carefully and applied properly, the electric tools sometimes equal or outperform their pneumatic counterparts in terms of productivity, cost effectiveness, and user acceptance. However, any alteration of tooling entails complex subjective factors and customs so that effecting changes can risk, at least temporary, decreases in productivity.

33554 **(ORNL/TM—9072) Performance test results of a lithium bromide-water absorption heat pump that uses low-temperature [60°C (140°F)] waste heat. Final report.** Huntley, W.R. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013129.

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An absorption heat pump for upgrading industrial waste heat to process steam temperatures has been developed and successfully tested at Oak Ridge National Laboratory. The heat pump uses lithium bromide and water as the working fluids and is designed to operate with waste heat temperatures ranging from 60 to 100°C (140 to 212°F). Performance data from the 45-kW(t) (12.5-ton) prototype heat pump have shown good agreement with theoretical predictions. Advantageously, most of the energy for operation comes from the waste heat, with only low inputs of electrical energy for parasitics; electrical coefficients of performance ranging from 50 to 85 have been demonstrated. This feature makes the heat pump attractive from the standpoint of energy conservation. The successful operation of this absorption heat pump prototype has demonstrated that this concept is an easily operated and practical candidate for energy recovery from waste heat in industrial applications where low-temperature process steam is needed. An adiabatic absorber section was incorporated into this machine to allow the diluted absorbent to reach its maximum temperature before delivering heat to the load. However, the kinetics of the absorption reaction were faster than anticipated from the design calculations, and this feature was not advantageous for operation with lithium bromide-water. The prototype heat pump tested is a single-stage machine, but two-stage versions have been theoretically evaluated which could obtain about twice the temperature boost when required. An economic analysis shows attractive payback times over a wide range of operating temperatures.

33555 **(PB—84-152347) Industrial waste heat recovery and the potential for emissions reduction. Volume 1. Main report. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 270p. NTIS, PC A12/MF A01.

See also PB84-152354.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33556 **(PB—84-152354) Industrial waste heat recovery and the potential for emissions reduction. Volume 2. Standard Classification Codes 1-01-001-01 to 1-02-007-03. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 524p. NTIS, PC A22/MF A01.

See also PB84-152362.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33557 **(PB—84-152362) Industrial waste heat recovery and the potential for emissions reduction. Volume 3. Standard Classification Codes 1-02-007-04 to 2-03-999-98. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 544p. NTIS, PC A23/MF A01.

See also PB84-152370.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U. S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33558 **(PB—84-152370) Industrial waste heat recovery and the potential for emissions reduction. Volume 4. Standard Classification Codes 2-04-001-01 to 3-01-025-05. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 548p. NTIS, PC A23/MF A01.

See also PB84-152388.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature,

and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33559 **(PB—84-152388) Industrial waste heat recovery and the potential for emissions reduction. Volume 5. Standard Classification Codes 3-01-025-10 to 3-02-013-01. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 528p. NTIS, PC A23/MF A01.

See also PB84-152396.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33560 **(PB—84-152396) Industrial waste heat recovery and the potential for emissions reduction. Volume 6. Standard Classification Codes 3-02-014-01 to 3-04-002-03. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 552p. NTIS, PC A24/MF A01.

See also PB84-152404.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33561 **(PB—84-152404) Industrial waste heat recovery and the potential for emissions reduction. Volume 7. Standard Classification Codes 3-04-002-04 to 3-05-010-03. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 572p. NTIS, PC A24/MF A01.

See also PB84-152412.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33562 **(PB—84-152412) Industrial waste heat recovery and the potential for emissions reduction. Volume 8. Standard Classification Codes 3-05-010-99 to 3-06-010-01. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 589p. NTIS, PC A25/MF A01.

See also PB84-152420.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33563 **(PB—84-152420) Industrial waste heat recovery and the potential for emissions reduction. Volume 9. Standard Classification Codes 3-06-011-01 to 3-90-005-33. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 546p. NTIS, PC A23/MF A01.

See also PB84-152438.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as a means of air pollution control. Predictions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in

this report. Volume 1 describes study methodology and findings. Volumes 2 through 10 tabulate stack gas waste heat inventories for all the industrial processes studied.

33564 **(PB—84-152438) Industrial waste heat recovery and the potential for emissions reduction. Volume 10. Standard Classification Codes 3-90-005-99 to 3-90-008-99. Final report 25 Oct 77-28 Mar 79.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1984. 517p. NTIS, PC A22/MF A01.

See also PB84-152420.

This report examines the applicability of conservation equipment to various industrial sectors, determines the net costs involved, and assesses the potential for conservation as an means of air pollution control. Predicitions of the amount of waste heat available from U.S. industrial sources were made and a waste heat inventory was established. The inventory is segmented by industrial group, industry, process, and flue gas temperature. The waste heat recovery equipment analysis determined the costs and applications of a variety of waste heat recovery equipment. The analysis examined five major equipment types and their limitations. Cost functions were developed which used furnace flue gas flow rate and temperature, and air preheat temperature as inputs. A discussion of the major factors to be considered for the development of heat recovery equipment also is included. A discussion on the availability and development of high temperature burners and the effects of high preheat temperature on ancillary equipment is included. High preheat temperatures result in higher flame temperatures and correspondingly higher NOx emissions. This issue also has been addressed in this report. Volume 1 describes study methodology and findings. Volume 2 through 10 tabulate stack gas waste heat inventories for all the industrial process studied.

33565 **(PB—84-155225) Geotechnical quality assurance of construction of disposal facilities. Final report Apr-Dec 82.** Spigolon, S.J.; Kelley, M.F. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Feb 1984. 192p. NTIS, PC A09/MF A01.

This report presents four major topics related to the permittee's responsibilities during construction,operation, and closure of a hazardous waste disposal facility: (1) geotechnical parameters that should be tested and/or observed, (2) selection of sampling methods and sample sizes for the geotechnical parameters, (3) laboratory and field testing methods for investigating geotechnical parameters, (3) laboratory and field testing methods for investigating geotechnical parameters, and (4) a quality assurance program suited to the unique responsibilities of the permittee. The purpose of the report is to provide technical background for use by permittees, designers, specifiers, quality assurance engineers, and permit writers for hazardous waste disposal facilities. The document addresses the quality control aspects of construction, operation, and closure of a hazardous waste disposal facility (it is assumed that the quality aspects of site selection, characterization, and design have already been managed). Types of facilities covered by the report include landfills, surface impoundments, waste piles, and land treatment units.

33566 **(PB—84-171594) Electric boilers.** (Informationsstelle fuer Elektrizitaetsanwendung, Zurich (Switzerland)). 1983. 49p. (In Swedish). NTIS, PC E04/MF E04.

Electric boilers have been used in Switzerland since 1920 for industrial heat supply, but oil boilers began to replace them to the extent that their energy consumption dropped from 1,000 GWh in 1950/51 to 120 GWh by 1980/81. This study examines whether petroleum substitution might again be possible in the process heat sector. This means heavy-duty electric boilers of up to 60 t/h, 1 - 40 MW connecting power and 380 V to 20 kVconnecting voltages. They can be used to generate hot water and/or saturated steam. Electric boilers make about the same demands on feed water as fossil-fired low-pressure steam boilers. Maintenance costs for electric boiler are somewhat lower. In bivalent operation with a fossil-fired boiler, electric boilers can be switched without too many problems. Network problems are chiefly those of covering grounding, for which every installation must be checked individually.

33567 **(PB—84-174713) High-efficiency commercial water heater development. Annual report Jan-Dec 83.** Demetri, E.P.; Vasilakis, A.D.; Gerstmann, J. (Advanced Mechanical Technology, Inc., Newton, MA (USA)). Jan 1984. 58p. NTIS, PC A04/MF A01.

The development of a condensing water heater for commercial applications has been completed. The selected concept consists of a high-efficiency water heater connected by appropriate plumbing to a stratified-temperature storage tank. A number of pre-production prototypes have been fabricated and installed at nine representative commercial sites. Field tests were initiated in April 1983. These consist of a side-by-side comparison with the existing conventional water heater at each site. The test results obtained to date demonstrate standby loss rates less than one-fifth of conventional values and service efficiencies which average 33% higher than conventional system efficiencies. The comparative performance data obtained under actual usage conditions show that the condensing water heater would provide average annual cost savings of $950 per year and corresponding paybacks in the range of 0.6-1.5 years.

33568 **(PB—84-174895) Heat recovery with a condensor and a direct contact heat exchanger.** de Jong, E.J.; van der Linden, J.P. (Technische Hogeschool Delft (Netherlands). Afdeling der Werktuigbouwkunde). Sep 1983. 77p. (In Dutch). NTIS, PC E05/MF E01.

33569 **(PB—84-180637) Ceramic fiber insulated furnace research program. Annual report Jul 81-Sep 82.** Kiefer, J.R.; Sodolak, L.S. (Cameron Iron Works, Inc., Houston, TX (USA)). Jan 1983. 122p. NTIS, PC A06/MF A01.

See also PB81-202004. Color illustrations reproduced in black and white.

The objective of this program is to determine methods for Energy Conservation through the use of ceramic fiber insulation (i.e. alumina-silicate man made fibers). Ceramic fiber-products will be tested in the same modes of construction: (1) Ceramic fiber layered construction, (2) Ceramic fiber veneer, (3) Ceramic fiber modules, for test comparison with the State-of-Art hard refractories (brick and/or castables). The ceramic fibers have excellent thermal stability and low heat storage. In both, hard refractory and ceramic fiber tests, the calculated wall temperature profiles are higher than the measured values. This indicates that the published thermal conductivities are higher than actual values. The savings in fuel used for layered ceramic fiber amounted to 40% less than the hard refractory lined furnaces under the same test conditions. The fuel used for the hard refractory (18 inches) plus ceramic fiber veneer (3 inches) was 31% less than hard refractory furnace under the same test conditions. Fuel savings as high as 57% have been noted in ceramic fiber lined test furnaces (Batch Operation).

33570 **(VTT-TIED—190) Energy research in the mechanical forest industry 1980-1982. Literature survey of wood panel industry.** Soeyrilae, P.; Koskela, K.; Jaervi, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Mar 1983. 86p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland. Order Number TI84751041.

The total energy consumption of plywood production is about 7.7 GJ/m³. About 70% of thermal energy goes to veneer drying. The biggest energy saving have been achieved by influencing the drying process: the amount of the exhaust air of the dryer is adjusted as low as possible, the filling degree of the dryer is kept as high as possible, the final moisture content of veneer is raised as high as the gluing process allows, the changes in the initial moisture content of veneer are considered in drying either with the aid of the adjusting automatics of the dryer or by a primary grading of veneers. In the manufacture of particle board the total energy consumption is in average 3.6 GJ/m³. The energy amount needed for particle drying can be diminished by striving at a final moisture content of particles that is as even and as high as possible, by using the dryer at the highest possible filling degree, by raising the drying temperature and by recirculating the exhaust gas. In the production of fibreboard the total energy consumption is in average 9.3 GJ/t (hardboard) and 13.7 GJ/t (insulation board). The energy consumption can be diminished especially in defiberizing by softening the chips more effectively either by lengthening the time for preheating

or raising the pressure or by using some additional chemical, e.g. NaCH. Softening can be carried out by leading the waste steam from defibrator intochip silo for melting and preheating the chips.

33571 **(VTT-TUTK—149) Energy research in the mechanical forest industry 1980-1982. Energy saving in the manufacture of fibreboard.** Jaervi, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1983. 50p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland. Order Number TI84751042.

The aim of the investigation was to clarify whether energy can be saved in defiberizing in the manufacture of fibreboard by adding a suiting chemical to chips in the preheating phase or by leading the waste steam from defibrator into chip silo. The effect of chemicals was investigated both by laboratory and mill tests. The chemicals used were lye (NaOH) and sodium bisulphite ($NaHSO_3$). Although the results show saving in the consumption of electric energy, the profit is not great enough to cover the expenses incurred on the chemicals. An additional charge is the increase in the waste water load especially when lye is used. In connection with the investigation of the use of waste steam also an adaptable equipment was being developed. The tests carried out thereafter showed that the amount of fresh steam used in preheating can be decreased by leading waste ssteam from defibrator into chip silo. The saving gained is of size class 125 kg steam per produced pulp ton. If the price of thermal energy is estimated to be 32 Fmk/GJ,Savings of 11 Fmk per pulp ton are gained by procedures mentioned above. The total annual production of such mills that can exploit waste steam in this way is abt. 125 000 t. This means a possibility to save abt. 1.4 mill.Fmk yearly. The investments needed are of size class 150 000 mk.

33572 **(VTT-TUTK—160) Energy research in the mechanical forest industry 1980-1982. The energy service of integrates.** Tarvainen, V. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Mar 1983. 19p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland. Order Number TI84751040.

An inquiry about the energy management of the mechanical forest industry was sent to production units consisting of two or more factories. 29 integrates answered to the inquiry, and 21 answers were applicable to further investigation and analysis. Their total energy production was 7530 TJ in 1979, which covered one third of the total energy demand of the mechanical forest industry. The integrates' production of thermal energy exceeded their own consumption. Regarding electricity, the average self-support degree was only 40%. Two thirds of the energy was produced by domestic energy sources, 20% were purchased fuels. The most important domestic energy source was bark. The proportions of chips, sawdust and peat were 13.1%, 16% and 14.7%. The rest consisted of water power and miscellaneous wood combustibles. The most important foreign fuel was oil, also natural gas and coal were used. The figures mentioned above may not be generalized because at least in minor plants the use of by-products as fuel is not always profitable. Such plants buy their electricity and produce heat by means of oil.

33573 **(VTT-TUTK—161) Energy research in the mechanical forest industry 1980-1982. Energy consumption in the impregnation of poles and sawn timber.** Tarvainen, V.; Mansikkamaeki, P. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Mar 1983. 30p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland. Order Number TI84751035.

Energy consumption in the impregnation of poles and sawn timber in 1979 was studied by addressing an inquiry to the biggest impregnation plants. Information was requested on power and heat consumption and on power installed in separate process phases. For background information, some aspects of the production process were also requested. The plants which answered the inquiry produced about one half of the 302 000 cubic metres of timber impregnated in 1979. The average consumption of electricity was 51 MJ/m^3 . The heat needed in the impregnation of poles by creosote oil was 651 MJ/m^3. In the impregnation of poles by waterborn preservatives the heat consumption was on an average 56 MJ/m^3 and in the impregnation of sawn timber 42 MJ/m^3. The total power consumption by all impregnation plants was 15.4 TJ and the heat consumption 104 TJ. THe impregnation industry accounted for 0.4% of the power consumption and 0.5% of the heat consumption of the whole mechanical forest industry. The energy consumption of impregnation in different plants varied very much. The deviations from the smallest consumption are partially due to differences in the technical level of the plants and variation in raw material. With some suitable technical solutions and organizational actions it is obviously possible to gain great savings.

33574 **(VTT-TUTK—200) Energy research in the mechanical forest industry 1980-1982. Energy consumption in the particle board industry.** Usenius, A.; Koskela, K. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jul 1983. 49p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland. Order Number TI84751036.

Energy consumption in the manufacture of particle board in 1979 was clarified by means of an inquiry. Questionnairies were sent to thirteen particle board mills,All of which answered the questions. The total production of the particle board industry was about 790 000 m^3,One fifth of which was processed products. On an average 1.5 m^3 wood raw material and 1.6 direct working hours were needed per one cubic metre of manufactured particle board. The values of installed power calculated per annual capacity varied from 43 W/m^3 to 88 W/m^3 when the average was 57 W/m^3. The total installed power of the Finnish particle board industry was about 59 000 kW. The specific energy consumption as for electricity varied from 145 kWh/m^3 to 273 kWh/m^3 when the average was 183 kWh/m^3. With reference to heat, the specific energy consumption varied from 2.2 GJ/m^3 to 3.3 GJ/m^3 when the average weighted by production was 2.74 GJ/m^3. The proportion of heat of the total energy consumption was on an average 79%. The process stages that consumed most electricity were the pretreatment of wood and screening, in which the energy consumption was 30%. The consumption in the drying and screening of particles was about 20%. The drying of particle, in which 80% of thermal energy was consumed, was clearly the most heat consuming process stage. The Finnish particle board industry consumed 145 GWh of electrical and 2 169 TJ of thermal energy in 1979.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 32782, 32792, 33926

33575 **(AD-A—139861/9) Initial feasibility report on decentralized small cogeneration for Navy shore bases. Final report 1 Oct 82-30 Sep 83.** McCold, L.N.; Karnitz, M.A. (Oak Ridge National Lab., TN (USA)). Feb 1984. 81p. NTIS, PC A05/MF A01.

This report presents the results of an assessment of decentralized small cogeneration application for Navy shore facilities. For the purpose of this study, small cogeneration includes packaged, preengineered cogeneration systems with electric generating capacities below about 500 kW. The characteristics of the available small cogeneration equipment are collected and summarized. The available energy use data on hospitals, unaccompanied enlisted personnel housing (UEPH) and unaccompanied officer personnel housing (UOPM) at four Navy bases are analyzed. A method for applying small cogeneration equipment to such facilities is developed and used. The energy and economic characteristics of these applications are summarized and discussed. Four economically attractive decentralized small cogeneration applications are identified.

33576 **(ANL/CNSV-TM—134-Vol.3) Study of existing RDF-cofiring experience. Volume 3. Phase II final report.** Fiscus, D.E.; Ege, H.D.; Petersen, R.D.; Glaub, J.C.; Joensen, A.W.; Wolfs, K.E.; Savage, G.M. (Midwest Research Inst., Kansas City, MO (USA)). Oct 1983. Contract W-31-109-ENG-38. 176p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013101.

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The major factors of design and operation of the boiler system, which includes the boiler, materials handling of RDF to the boiler, materials handling of bottom ash from the boiler, and other

auxiliaries are covered. RDF fuel properties and the major considerations of RDF processing are discussed. The emphasis is on the major factors of utility boiler design and operation and on viewing RDF as a fuel in the same manner as any other fuel would be. The basic concern is that existing utility boilers were designed for one type of solid fuel (coal) and cofiring RDF presents the boiler with a fuel mix whose properties are different from those for which the boiler was designed. For new boilers, the designers must take into account a fuel mix with different properties than normally used. For both retrofit and new boilers, boiler operations will be different when cofiring RDF than when firing coal only. This document presents results of the review of the state of the art of electric utility RDF projects.

33577 **(BNL—34540) Computer models and district heating and cogeneration feasibility analysis.** Reisman, A.W. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 11p. (CONF-8406132—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012902.

From 75. annual international district heating conference; Bretton Woods, NH, USA (17 Jun 1984).

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Estimation of the economic and technical feasibility of a district heating or cogeneration project involves the collection, integration, and assessment of large quantities of technical, market, and financial data. The emergence of the computer as an accessible and cost-effective tool available to all has begun to open up possibilities for easing this analytic burden in the first planning phase (Phase I - initial project analysis) and second planning phase (Phase II - detailed project design). This paper examines the benefits of using computer models in the analysis of district heating and cogeneration projects and provides a checklist for model selection. In addition, mention is made of the International District Heating Association (IDHA) Models Handbook project, which has as its goal the identification and description of existing public and proprietary district heating and cogeneration models which are available today to assist project planners to design large-scale community energy systems.

33578 **(DOE/CS/20544—T1) Pulsed-flow air classification for waste to energy production. Final report.** Peirce, J.J.; Vesilind, P.A. (Duke Univ., Durham, NC (USA). Center for Environmental Engineering). 30 Sep 1983. Contract AC05-79CS20544. 153p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013655.

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The development and testing of pulsed-flow air classification for waste-to-energy production are discussed. Standard designs generally permit large amounts of combustible material to escape as reject while producing a fuel that is high in metal and glass contaminants. Pulsed-flow classification is presented as a concept which can avoid both pitfalls. Each aspect of theory and laboratory testing is summarized: particle characteristics, theory of pulsed-flow classification, laboratory testing, and pulsed-flow air classification for waste-to-energy production. Conclusions from the research are summarized.

33579 **(DOE/RA/50327—1) Tri-County solid waste-to-fuel production project feasibility study.** (ECO Corp., Washington, IL (USA)). Sep 1983. Contract FG01-80RA50327. 425p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84013547.

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The analysis and preliminary findings of refuse-derived fuel and recovered components markets are presented. Other topics covered are: municipal solid waste composition, quantity and constraints; technical assessment and capital cost assessment; economic feasibility of burning process residue to generate steam; review of commercially available equipment for the densification of refuse-derived fuel; final pre-feasibility analysis for the Tri-County Municipal Solid Waste to Fuel Production Project; preliminary economic and sensitivity analysis for the Tri-County Project; risks assessment for the Tri-County Project; and environmental, health, safety, and socioeconomic assessment for the Tri-County Project. (MHR)

33580 **(ORNL/CON—152) Analysis of a small steam district heating system at Ft. McClellan, Alabama.** Pine, G.D. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014421.

An analysis to identify major causes for heat loss from one steam district heating system at Ft. McClellan, Alabama, has been made. Because only limited information based on measurements was available, we took measurements of condensate ejected from traps and of ground temperature profiles above buried steam pipes and combined these limited data with analyses of the building heat loads, heat loss from the buried pipelines, and the steam flow through the pipes to develop estimates of the energy efficiency of the distribution system. Based on these estimates, we concluded that the system efficiency (steam delivered to the buildings/steam entering the distribution system) is approximately 53%. Major identified sources of heat loss include conduction losses enhanced by the deterioration of the pipe insulation and flooding of valve pits and pipe conduits by the buildup of groundwater and condensate after failures of sump pumps. Leaks of prime steam do not appear to be a significant source of loss. Measures recommended to reduce the heat losses include providing better maintenance for sump pumps in vaults and reducing the operating pressure of the steam system. The latter measure is the more effective of the two. We estimate that reducing the operating pressure from its present 100 to 50 psig would reduce heat losses by 15% and would save the Army an estimated $43,000/year.

33581 **(PB—84-155175) Cogeneration: status and environmental issues. Final report Jun 79-Jul 81.** Dadiani, J. (TRW Energy Engineering Div., McLean, VA (USA)). Feb 1984. 81p. NTIS, PC A05/MF A01.

The purpose of this project was to determine the planned cogeneration development by the utility and industrial sectors; to assess the environmental impacts and energy savings from cogeneration; and, to identify potential environmental issues and regulations impacting cogeneration development. Major emphasis was placed on environmental impacts. The study investigated the energy savings and environmental impacts of five industrial facilities which are considering a switch to in-plant cogeneration. Potential regional environmental impacts of cogeneration development in New England, the Tennessee Valley Authority service area and northern New Jersey were also determined. Finally, the environmental impacts of a cogeneration-based district heating system were considered. It was found that there are a number of factors which determine the relative magnitude of environmental impacts of a cogeneration system compared to a conventional energy supply system.

33582 **(PB—84-165455) Rationalization of energy use in future Colombian buildings.** Suarez, A.V. (Universidad de Los Andes, Bogota (Colombia). Centro de Estudios e Investigacion). 1982. 43p. (In Spanish). (I—1). NTIS, PC A03/MF A01.

This study on the rationalization of energy use in Colombia begins with some standards of energy consumption in the United States and presents some aspects of the relationship between engineering and architecture there. It then reviews the work on this subject which has been done in Colombia, and points out areas where work needs to be done. It also indicates some aspects which should be analyzed and regulated concerning design and construction. The report then shows a practical example of rationalizing energy use in a Bogotan residence.

33583 **Measuring the benefits and costs of utility conservation and load-management programs.** Hirst, E. (Oak Ridge National Lab., TN). *Energy Policy;* **12**: No. 2, 219-220(Jun 1984). (CONF-8311175—).

From 95. annual convention and regulatory symposium of the National Association of Regulatory Utility Commissioners (NARUC); Detroit, MI, USA (14 Nov 1983).

Much less has been learned than could have been from utility operation of conservation and load management programs. This general ignorance concerning the performance (i.e., benefits and costs) of these programs exists because the authors have not devot-

ed sufficient resources to careful evaluations of past and present programs. The authors need to build evaluation into the program planning and implementation process, and the authors should use actual electricity and gas bills to measure program performance. Finally, the authors should conduct well designed experiments to learn what does and does not work.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 32934, 33479, 33480

33584 **(DOE/CS/10308—T1) Hispanic business community participation in conservation and solar energy. Final report.** (Latin American Manufacturers Association, Washington, DC (USA)). 1984. Contract FG01-80CS10308. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013688.

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This report summarizes the accomplishments made by the Latin American Manufacturers Association (LAMA) in a effort to promote the research, development, and commercialization of energy technologies supported by the DOE Conservation and Solar Applications (CSA) Division. Activities included the identification of Hispanic manufacturing and technical firms with energy-related capabilities, the dissemination of information to the Hispanic business community regarding DOE/CSA activities, and a pilot marketing effort designed to enhance Hispanic business involvement in the procurement activity of CSA-funded organization.

33585 **(DOE/RG/10063—T2) Summary of interview survey of electric utility communication specialists.** Ludwig, S.; Messe, L.A.; Crano, W.D. (Michigan State Univ., East Lansing (USA). Center for Evaluation and Assessment). 11 Nov 1980. Contract FG01-79RG10063. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013296.

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The survey yielded a great deal of useful information. It provided the staff members of the Center for Evaluation and Assessment with a focus for their efforts with regard to developing guidelines and mechanisms for effective communication between electric utilities and their customers. Moreover, the interviews confirmed the staff's initial judgment that there are substantial problems that must be overcome if communication programs are to be effective; at the same time, these conversations with communication specialists in the utility industry reinforced a sense that these issues must be addressed, since effective, open communication has to be a key component in any comprehensive attack on large-scale energy related problems.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 33611

33586 **(AD-A—137492/5) Preliminary assessment of a rotary detonation engine concept. Master's thesis.** Monks, S.A. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1983. 114p. NTIS, PC A06/MF A01.

Results of a preliminary, experimental assessment of a rotary detonation engine concept are reported. Measurements were taken of the torque produced by a stationary rotor model as a result of a single detonation process initiated within the rotor under known premixed gas conditions. Mixtures of ethylene and oxygen and ethylene and oxygen with three moles of nitrogen ballast were utilized. The results represent the lower bound to values of torque produced by the rotor model. Modifications of the instrumentation and torque measurement system are recommended to allow the transient process and resulting torque to be measured in greater detail, a comparison to be made with the results of numerical modeling, and a definitive assessment of the potential of the concept to be concluded.

33587 **(AD-A—139457/6) Thermal energy recovery in gas turbine engine test cells. Final report Oct 82-Sep 83.** Kodres, C.A. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Nov 1983. 112p. (NCEL-TN—1679). NTIS, PC A06/MF A01.

The economics of thermal energy recovery in jet engine test cells is examined. A numerical model to simulate the test cell augmenter tube is developed. This model is employed to determine the feasibility of installing heat exchangers along the augmenter or at the augmenter exit and using these heat exchangers to generate steam or electricity from the thermal energy in the jet exhaust. In general, energy recovery is not practical. The exhaust is quickly diluted by the entrained augmentation air, decreasing temperature gradients necessary for heat transfer. Most test cells are used too infrequently to warrant the cost of the hardware.

33588 **(AD-A—953090/8) 3 kw closed Rankine-cycle powerplant. Final report 19 May 66-31 Mar 73.** Teagan, W.P.; Morgan, D.T. (Thermo Electron Corp., Waltham, MA (USA)). Jun 1973. 290p. (TE—5092-99-72). NTIS, PC A13/MF A01.

33589 **(BMFT-FB-T—84-006) Development of high temperature ceramic parts for vehicular gasturbines.** Huehter, W.; Krueger, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Motoren- und Turbinen-Union G.m.b.H., Muenchen (Germany, F.R.)). Jan 1984. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751277.

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In the second three-years program, ceramic components for a truck gas turbine were designed and tested. A combustion chamber variant of SiC + Si survived a running time of 22.3 hours without damage under pressure conditions with cyclic load. The inlet cone of fabricated design remained free of cracks in all test runs. Stator variaties were tested at 1650 K. No damage occurred in stator segments. Integral stators had cracked shrouds. Tests under operation pressure are being prepared. The turbine disc concept - metallic disc with set-in ceramic blades - of the first ceramic program was modified following a reconsideration of construction data. HPSN blade dummies have survived 5000 load cycles from 0 to 465 m/s circumferential speed with reference to the blade central cross section (construction datum 387 m/s) without damage in the cold spin test. Blades of HPSN and RBSN were tested in the hot spin test (maximum gas temperature 1470 K). Material characteristics were established for the ceramic sorts - HPSN, RBSN, SiC + C - used at present. Methods for processing the ceramics were further developed. Main features were ultrasonic countersinking and shape-grinding.

33590 **(DOE/NASA/50194—39) Cold-air performance of compressor-drive turbine of Department of Energy upgraded automobile gas turbine engine. III. Performance of redesigned turbine.** Roelke, R.J.; Haas, J.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). May 1984. Contract AI01-80CS50194. 39p. (NASA-TM—83627). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013664.

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The aerodynamic performance of a redesigned compressor-drive turbine of the Department of Energy Upgraded Gas Turbine engine was determined in air at nominal inlet conditions of 325 K and 0.8 bar absolute. The turbine was designed with a lower flow factor, higher rotor reaction and a redesigned inlet volute compared to the first turbine. Comparisons between this turbine and the originally designed turbine showed about 2.3 percentage points improvement in efficiency at the same rotor tip clearance. Two versions of the same rotor were tested: an as-cast rotor and the same rotor with reduced surface roughness. The effect of reducing surface roughness was about one-half percentage point improvement in efficiency. Tests made to determine the effect of Reynolds number on the turbine performance showed no effect for the range from 100,000 to 500,000.

33591 **(PB—84-164243) Influence of cool engines on car fuel consumption. Supplementary report.** Armstrong, B.D. (Transport and Road Research Lab., Crowthorne (UK)). 1983. 12p. (TRRL-SUPPLEMENTARY—822). NTIS, PC E03/MF E03.

The report concludes that the extra fuel used, because engines are not fully warm at all times, is roughly one third of the present national consumption by cars. A national sample of car diaries, collected with the National Travel Survey in 1978-79, has made it possible to make a new estimate of the effect of cool engines on fuel consumption. For the first time it has been possible to make a detailed allowance for the effect of trips which start with the engine already warm. (Copyright (c) Crown Copyright 1983.)

33592 **(VW-FMT—8208-V/5) Development of probes for measuring fuel and air flow as well as fuel remaining in production automobiles.** (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.). Abt. Forschung und Entwicklung). 13 Sep 1982. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751282.

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This survey is also subject matter of the report of a research project promoted by the Federal Ministry of research and development under the title: Development of probes for measuring fuel and air flow as well as fuel remaining in production automobiles. Fuel flow measuring methods according to thermal, hydrometric vane and correlation principles were tested. Based on these results, probes qualified for automobiles were developed. For probes according to the thermal principle, solutions were found to prevent thermal and hydrodynamic interference. For the hydrometric vane one of the goals achieved was a considerable measuring margin decrease. As far the correlation probe, principles for promising solutions were found. Optical and electrical methods were used to examine and clarify the physical mechanism of the conventional rotational flow method. A miniature probe for air flow was developed according to this method. Various methods for the determination of fuel remaining were analysed. This included comprehensive studies on a method using both level and consumption measurement methods. This way small quantities of fuel remaining in a automobile in motion can be determined more accurately than by the conventional float-controlled measurement.

3302 External Combustion Engines

33593 **(CONF-840804—13) SEAMOPT - Stirling engine optimization code.** Heames, T.J.; Daley, J.G. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012098.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Experience is described with use of a fast-running Stirling engine optimization code developed at Argonne intended for public release. Stirling engine modeling is provided by the SEAM1 thermodynamic code. An interface was written to combine SEAM1 with a general optimization code and assess maximum component stress levels. Thus full engine thermodynamic and structural simulation is done during the optimization process. Several examples of the use of this code to optimize the GPU-3 engine are described. In one case efficiency was improved by over 25%.

33594 **(DOE/NASA—1005-3) Comparison of free-piston Stirling engine model predictions with RE1000 engine test data.** Tew, R.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1984. Contract AI05-82OR21005. 19p. (CONF-840804—10; NASA-TM—83650). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011501.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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Predictions of a free-piston Stirling engine model are compared with RE1000 Sunpower engine test data taken at NASA-Lewis Research Center. A kinematic code was upgraded to permit simulation of free-piston engine performance; it was further upgraded and modified and is currently being validated. The model predicts engine performance by numerical integration of equations for each control volume in the working space. Piston motions are determined by numerical integration of the force balance on each piston or can be specified as Fourier series. In addition, the model Fourier analyzes the various piston forces to permit the construction of phasor force diagrams. The paper compares predicted and experimental values of power and efficiency and shows phasor force diagrams for the RE1000 engine displacer and piston. Further development plans for the model are also discussed.

33595 **(DOE/NASA—51040-55) Creep-rupture behavior of candidate Stirling engine alloys after long-term aging at 760°C in low-pressure hydrogen.** Titran, R.H. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). May 1984. Contract AI01-77CS51040. 43p. (NASA-TM—83676). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013537.

Nine candidate Stirling automotive engine alloys were aged at 760°C for 3500 h in low pressure hydrogen or argon to determine the resulting effects on mechanical behavior. Candidate heater head tube alloys were CG-27, W545, 12RN72, INCONEL-718, and HS-188 while candidate cast cylinder-regenerator housing alloys were SA-F11, CRM-6D, XF-818, and HS-31. Aging per se is detrimental to the creep-rupture and tensile strengths of the iron-base alloys. The presence of hydrogen does not significantly contribute to strength degradation. Based on current MOD 1A Stirling engine design criteria of a 55% urban - 45% highway driving cycle; CG-27 has adequate 3500 h - 87°C creep-rupture strength and SA-F11, CRM-6D, and XF-818 have adequate 3500 h - 775°C creep-rupture strength.

33596 **(ORNL/CON—154) Nonlinear analysis of Stirling engine thermodynamics.** Banduric, R.D.; Chen, N.C.J. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013493.

Numerical solutions to a simplified mathematical formulation for Stirling engine thermodynamics, including some major loss mechanisms and their interactions, are presented. The objective is to provide numerically accurate solutions to the nonlinear equations for verification of a simplified linear analysis recently developed at Oak Ridge National Laboratory. At this stage, the formulation requires that the piston motions be specified; that is, it does not include the dynamics of free pistons. The equations of the formulation were numerically solved, with no further simplifications, using a standard IBM software package, called the Continous System Modeling Program, that basically involves numerical integration. The results were used to show the effects of four major loss mechanisms on the performance parameters of the RE-1000 free-piston Stirling engine. These losses are: adiabatic cylinder effects, transient heat transfer, pressure drop, and seal leakage. The performance parameters calculated were power output and efficiency. Some discussion of the results and a further analysis of this engine model are also presented.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 33374, 33382, 33383, 33384

33597 **(AD-A—139719/9) Electric vehicle modeling and simulation. Technical report.** DeWispelare, A.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Aug 1983. 80p. NTIS, PC A05/MF A01.

The forecasting of the performance of electric vehicles has revealed many discrepancies when compared to actual test data. An electric vehicle computer simulation program was developed to ameliorate this deficiency. The approach was to establish a very comprehensive and flexible vehicle model and simulate its operation on a realistic driving cycle. The driving cycle selected was the Federal Urban Driving Sequence. A thorough vehicle model was established that incorporate aerodynamic drag, rolling asistance, both rotational and translational inertial effects, and component by component dynamic power train efficiencies. Battery discharge per-

formance is tracked by a fractional-utilization algorithm with corrections for short-term discharge effects. The simulation compares required power obtained from the driving cycle speed schedule and vehicle model characteristics with the available power at the motor for each time increment of the driving cycle to compute battery fraction used and deviation from the speed schedule when available power is insufficient. These results of the simulation can be used to evaluate an existing vehicle's performance or, if desired, to develop vehicle parameters to obtain a specified performance level. An application of the program to develop a suburban passenger vehicle is included to demonstrate the simulation's utility. A test bed vehicle was constructed and tested to verify the simulation. Additional aspects such as microprocessor based controllers including implementation of an optimal control law were investigated to gain insite into the efficiency and performance trade-offs of such a system.

33598 **(AD-A—140123/1) Testing and evaluation of jet electric vehicle models: 600, 1000, and 1000p. Final report FY 80-FY 83.** Mekari, M.H. (Army Tank-Automotive Command, Warren, MI (USA)). 29 Feb 1984. 44p. (TACOM-TR—4331). NTIS, PC A03/MF A01.

The major purpose of this program is to test the performance and the economy of contemporary electric vehicle versus conventional internal combustion engine vehicle for delivery type industrial applications. The test data of these three different types of vehicles, compared to similar conventional internal combustions engine vehicles, operated at same locations and conditions, show that conventional vehicles have advantages over the electric vehicles and that: total electric vehicle maintenance and energy cost is 58 cents/mile; and Total internal combustion engine vehicle maintenance and energy cost is 24 cents/mile. Other advantages and disadvantages are stated in the Conclusions paragraph of this report.

33599 **(CONF-840804—14) Computerized system for establishing electric-vehicle battery requirements.** Marr, W.W.; Walsh, W.J. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011728.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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This paper describes a computerized system for establishing performance requirements for electric vehicle batteries. This system, called EVA (Electric Vehicle Analysis), enables least-cost analyses to identify optimum battery characteristics for different vehicle types and missions. EVA incorporates various computational and modeling features from previous electric-vehicle analyses. It is a user-friendly, interactive software package that allows optimization of complex battery systems with relative ease.

33600 **(NP—4770264) Technical and economic aspects of design and use of electric passenger vehicles.** Bucher, W. (Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)). Jul 1982. 299p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84770264.

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The study investigates in how far vehicles with electric drive can be realised with todays state of development and whether they can be used when considering the present demand of use. Battery-driven electric passenger cars are in the centre of interest as they show the technical problems most distinctively. These problems are tackled in the following steps - description of the state of technology and the expected progress concerning components of the electric road vehicle; - considerations of energy and economy of the electric vehicle; - comparison of the driving performance of electric vehicles and conventional passenger cars; - comparison between battery-driven electric vehicles and fuel-cell driven vehicles and vehicles with hybrid drive; - questions of infrastructure (power generation and -distribution for electric vehicles).

33601 **(PB—84-187715) Board discharge limiting device and bad module detector for electric vehicles. Final report.** Nowak, D. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Mar 1983. 26p. (UAH—363). NTIS, PC A03/MF A01.

Sponsored in part by Aerospace Corp., Washington, DC.

A warning device for electric car batteries was developed and tested. The device determines the end of discharge of a battery pack, determines the weakest module in the pack and tests for bad battery modules.

33602 **Battery capacity measuring device for electric vehicles.** Simas, V.R.; Hammersley, W.F. (OAO Corp., Washington, DC). *Proceedings - Electrochemical Society;* **81-82**: 23-24(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33603 **Alkaline nickel electrode voltage vs. current performance.** Maskalick, N.J. (Westinghouse Electric Corp., Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 90-91(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33604 **Electrode characteristics of the iron-air battery.** Buzzelli, E.S. (Westinghouse Electric Corp., Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 298-299(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33605 **Urban electric vehicles with iron-air batteries.** Gibney, A.; Buzzelli, E.S.; Ulerich, P. (Westinghouse Electric Corp., Pittsburgh, PA). *Proceedings - Electrochemical Society;* **81-82**: 300-301(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33606 **Mechanically-refuelable aluminum-air battery.** Cooper, J.F.; Homsy, R.V.; Landrum, J.H.; Perone, S.P. (Lawrence Livermore National Lab., CA). *Proceedings - Electrochemical Society;* **81-82**: 307-309(1981). (CONF-811013—Vol.81-82-Absts). Contract W-7405-ENG-48.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33607 **Electrochemistry determines the future of electric vehicles.** Kordesch, K.; Gsellmann, J.; Srinivasan, S.; McCormick, B. (Technische Universitaet Graz, Austria). *Proceedings - Electrochemical Society;* **81-82**: 1239-1240(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33608 **Speculations on battery systems of the future.** Huggins, R.A. (Stanford Univ., CA). *Proceedings - Electrochemical Society;* **81-82**: 1239-1240(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33609 **Fuel cells for transportation.** Huff, J.R.; McCormick, J.B.; Lynn, D.K.; Bobbett, R.E.; Derouin, C.; Srinivasan, S. (Los Alamos National Lab., NM). *Proceedings - Electrochemical Society;* **81-82**: 1250-1251(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33610 **Fuel cell power plants for electric vehicles: electrochemical aspects.** Srinivasan, S.; Gonzolez, E.R.; Maggiore, C.J.; Hsueh, K.L.; Derouin, C.; Chin, D.T. (Los Alamos National Lab., NM). *Proceedings - Electrochemical Society;* **81-82**: 1252-1254(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 33600

3308 Alternative Fuels

33611 **(AD-A—137312/5) After-test engine inspection of U.S. Army administrative and light-tactical vehicles operated on gasohol and unleaded gasoline. Interim report Oct 81-Feb 83.** Butler, W.E. Jr.; Frame, E.A.; Owens, E.C. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Feb 1983. 125p. (AFLRL—167; SWRI—6800-210/1). NTIS, PC A06/MF A01.

Eighteen spark ignition engines from U.S. Army administrative and light-tactical vehicles, which were part of a fleet test to determine the effects of operating such engines with gasohol as a fuel, were shipped to the U.S. Army Fuels and Lubricants Research Laboratory (USAFLRL) for after-test inspections. Twelve of the engines were operated with gasohol as a fuel, and six of the engines were operated with unleaded gasoline. Each engine was disassembled for inspections which included visual inspection, wear measurements of selected components, deposit ratings in accordance with CRC rating methods, and photographs of selected parts. No significant differences between engines operated with gasohol and those operated with unleaded gasoline could be determined by any of the inspection methods used. Consideration of the data generated from the inspections support the conclusion that gasohol may be successfully utilized in the U.S. Army's administrative and light-tactical vehicles.

36 MATERIALS

REFER ALSO TO CITATION(S) 32535

33612 **(AD-A—139865/0) Fuel-resistant coating and binders for porous friction surface pavements: tests and analyses. Final report May 80-Nov 83.** Shoenberger, J.S. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Geotechnical Lab.). Feb 1984. 66p. NTIS, PC A04/MF A01.

This report documents research to evaluate the ability of several products to render porous friction surfaces (PFS) resistant to damage from jet fuel and hydraulic fluid spillage. Test procedures and requirements used to select fuel-resistant binders and coatings for field trials are presented in detail. One field trial using one of the products found successful in the lab, Koppers RT14, was conducted with promising results.

33613 (INIS-BR—119, pp 117-118) **Radiocrystallographic study of rare minerals Leadhillita and Susannita.** Baptista, A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780333.

In Annual Progress Report of 1981.

33614 **(SAND—83-2332C) Numerical modeling of the drying of porous materials.** Hadley, G.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-840750—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013056.

From 4. international drying symposium; Kyoto, Japan (9 Jul 1984).

A numerical solution technique has been presented which solves in one dimension the coupled heat and mass flow equations for water, water vapor, and an inert gas moving through a porous medium. The physical effects included in the resulting computer program PETROS are more complete than for previous simulations, particularly for the gas phase transport. The latter includes effects due to binary gaseous diffusion and Knudsen diffusion as well as Darcy flow. PETROS is thus capable of simulating two-phase flow through porous media.

33615 **(UCID—18574-83-4) H Division. Materials Physics quarterly report, October-December 1983.** Moriarty J.A. (ed.). (Lawrence Livermore National Lab., CA (USA)). 13 Apr 1984. Contract W-7405-ENG-48. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013206.

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Reported are: equation-of-state (EOS) experiments on aluminum; static EOS work on uranium using ultra-high pressure diamond anvil apparatus; free-electron behavior and the friedel sum (for Cu and Al); theory of interatomic potentials in transition metals; a new, thermodynamically consistent, hybrid-integral equation for fluids and plasmas; second-order theory of spectral line shifts; electric microfield distribution at strong coupling and high temperature electron screening; shock amplified flow instability simulations; noninteractive and interactive simulations of compliant surface response; and homogeneous period heat flow via nonequilibrium molecular dynamics.

33616 **The thermal conductivity of semitransparent materials.** Fine, H.A.; Jury, S.H.; McElroy, D.L.; Yarbrough, D.W. (Dept. of Metallurgical Eng. & Materials Science Univ. of Kentucky Lexington, KY). pp 359-368 of Thermal conductivity. Vol. 17. Hust, J.G. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106164—). Contract W-7405-ENG-26.

From National Bureau of Standards joint conferences: 8. symposium on thermophysical properties; 17. thermal conductivity conference; 8. thermal expansion conference; Gaithersburg, MD, USA (15 Jun 1981).

This chapter uses the three-region approximate solution for coupled conductive and radiative heat transfer an exact solution for uncoupled conductive and radiative heat transfer in a grey semitransparent medium bounded by infinite parallel isothermal plates to establish the dependence of the apparent thermal conductivity of semitransparent materials on other material properties and boundary conditions. Demonstrates an application of the analyses, which uses apparent thermal conductivity on temperature. Finds that the predictions for seven sets of R-11 fiberglass and rock wool insulations agree with published measured values to within the limits of experimental error (+ or - 3%). Points out that agreement for three sets of R-19 fiberglass insulations was not good.

33617 **Illustrative numerical comparisons between phonon mean free paths and phonon thermal conductivity.** MacDonald, W.M.; Anderson, A.C. (Dept. of Physics & Materials Research Lab. Univ. of Illinois at Urbana-Champaign Urbana, IL 61801). pp 185-193 of Thermal conductivity. Vol. 17. Hust, J.G. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106164—). Contract AC02-76ER01198.

From National Bureau of Standards joint conferences: 8. symposium on thermophysical properties; 17. thermal conductivity conference; 8. thermal expansion conference; Gaithersburg, MD, USA (15 Jun 1981).

This chapter discusses the phonon thermal conductivity of a solid, and attempts to show the relationship with phonon mean free path. Points out that measurements of thermal conductivity are often used as an interrogative technique to learn about phonon scattering processes in solids. Examines the effects on thermal conductivity of anisotropy and of non-constant phonon mean free path while retaining the assumption of low temperature. Concludes that since there is no fast and reliable experimental method of inserting monochromatic phonons, having a frequency range of 1 GHz to 1 THz, into a variety of materials, it is likely that thermal conductivity measurements will continue to provide an important source of information on phonon scattering.

33618 **Application of parameter estimation techniques to thermal conductivity probe data reduction.** Koski, J.A.; McVey, D.F. (Sandia National Lab. Albuquerque, NM 87185). pp 587-600 of Thermal conductivity. Vol. 17. Hust, J.G. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106164—). Contract AC04-76DP00789.

From National Bureau of Standards joint conferences: 8. symposium on thermophysical properties; 17. thermal conductivity

conference; 8. thermal expansion conference; Gaithersburg, MD, USA (15 Jun 1981).

This chapter uses parameter estimation techniques to determine thermal conductivity from line heat source probe data. Describes a data reduction method that utilizes experimental temperature data at both early and late times, does not require full development of the classical linear temperature increase vs. logtime asymptotic behavior, is not as sensitive to data noise as other techniques, and permits evaluation of the experiment design and data assumptions through statistical analysis of final residuals (difference between the analytical solution and experimental data). Explains that the approach consists of obtaining a nonlinear least-squares fit between an analytical solution containing the parameters of interest (conductivity, contact resistance, and, in some cases, density-specific heat product) and experimental data. Examines sensitivity coefficients (derivatives of the parameters with respect to the measured variable) and demonstrates the adequacy of thermal conductivity as a fit parameter. Applies the method to analysis of laboratory and in situ field data.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 32504, 32669, 32711, 32780, 32781, 32920, 32921, 32922, 32928, 32931, 33181, 33182, 33183, 33186, 33186, 33200, 33204, 33205, 33207, 33207, 33208, 33208, 33209, 33228, 33595, 33806, 33818, 33859, 33868, 33937, 34560, 34777

33619 (AD-A—138581/4) Clarifiction of environmental effects in stress corrosion cracking. Final report 1 Jun 75-31 Dec 83. Foley, R.T. (American Univ., Washington, DC). Jan 1984. 26p. NTIS, PC A03/MF A01.

The objective of this project was to clarify the role of the environment in the stress corrosion cracking and the localized corrosion of aluminum alloys. Specifically, the project addressed the manner in which different chemical species, such as various anions, are involved in the corrosion process.

33620 (AD-A—139086/3) Corrosion control through a better understanding of the metallic substrate/organic coating/interface. Annual report No. 4, 1 Sep 82-30 Sep 83. Leidheiser, H. Jr.; Allen, E.M.; El-Aasser, M.S.; Fowkes, F.M.; Granata, R.D. (Lehigh Univ., Bethlehem, PA (USA). Center for Surface and Coatings Research). 1 Jan 1984. 248p. NTIS, PC A11/MF A01.

This report represents the fourth annual summary of research carried out under Office of Naval Research. The objective of this research is to obtain a better understanding of the metallic substrate/organic coating/interface system so that improvements may be made in corrosion control of metals by painting. The report this year includes a summary of progress made in 16 different components of the program. These activities are arranged for convenience into those primarily concerned with (a) corrosion at the interface, (b) the chemistry of the metal/coating interface, (c) the properties of the coating, (d) the properties of iron oxides with particular relevance to the painting of rusted steel.

33621 (AD-A—139649/8) Fracture behavior of a uranium and a tungsten alloy in a notched component with inertia loading. Final report. Underwood, J.H.; Scavullo, M.A. (Army Armament Research and Development Command, Watervliet, NY (USA). Large Caliber Weapon Systems Lab.). Dec 1983. 36p. (ARLCB-TR—83043). NTIS, PC A03/MF A01.

Presented at the National Symposium on Fracture Mechanics (16th), ASTM, Columbus, Ohio, 15-18 Aug 83.

A failure of a prototype long rod penetrator is described, including the stress and fracture analyses performed, the materials and service simulation testing performed, and the fracture toughness and nondestructive inspection requirements which were implemented. Results of a subsequent study are described, which involve the producibility of the long rod penetrator, particularly in relation to the complex fracture toughness testing methods which are required for use with this component.

33622 (BMFT-FB-T—84-007) Manufacturing and properties of aluminium sheet from mixed scrap materials. Lossack, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Vereinigte Aluminium-Werke A.G., Bonn (Germany, F.R.). Leichtmetall-Forschungsinstitut). Jan 1984. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751279.

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Mixed old scrap consists of non separable origin foundry alloys and wrought alloys. Melts from such scrap have to be blended with high amounts of primary metal to correct the composition for use in usual alloy fields. The investigation had to find out if mixed old(qcrap could belused for sheet manufacuuring without blending with primary metal at great extent. Two model compositions were chosen which refered to possible scrap mixtures. By d.c. casting into slabs, hot rolling and cold rolling sheet can be manufactured. In selected tempers this uncommon sheet showed good strength and formability properties. The existing corrosion problems with the sheet can be solved by suitable coating or preferably by cladding with selected clad alloys.

33623 (BNL—34778) Anodic processes and the kinetics of stress-corrosion cracking or corrosion fatigue. Newman, R.C. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 14p. (CONF-8310205—10). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012911.

From TMS-AIME fall meeting; Philadelphia, PA, USA (2 Oct 1983).

Transient electrochemical measurements on film-free metal surfaces have often been used to test models of environment-assisted crack growth. The history of these attempts is reviewed, and the results are assessed in the light of what we now know about mechanisms of stress-corrosion cracking and corrosion fatigue. 98 references.

33624 (CEA-R—5242) Positron annihilation technique applied to the study of inhomogeneous solids: aluminium alloys, layered compound 1T-TaS_2. Boileau, F. (Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1983. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751569.

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This thesis is an experimental investigation of inhomogeneous solids using the standard positron annihilation techniques (angular correlation of annihilation γ-rays, Doppler broadening, lifetime). The investigations are concerned with different types of more or less extended defects. The effect of impurities on the migration properties of the vacancy-type defects is first studied in electron irradiated and quenched aluminium alloys. The affinity of the positron for precipitates formed in supersatured aluminium alloys is shown experimentally and explained. The effects of low dimensionality on the behaviour of the positron are then studied in the layered dichalcogenide 1T-TaS_2 where the presence of charge density waves modifies the electronic properties. An experimental and theoretical insight on the Fermi surface of this compound has been successfully undertaken.

33625 (CONF-840520—9) Sputtering properties of copper-lithium alloys at reactor-level temperatures and surface erosion rates. Krauss, A.R.; Gruen, D.M.; Lam, N.Q.; DeWald, A.B. (Argonne National Lab., IL (USA); Georgia Inst. of Tech., Atlanta (USA)). 1984. Contract W-31-109-ENG-38. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013425.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

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Previous experiments on copper-lithium alloys at temperatures up to 250°C and with erosion rates of .01 to .1 monolayer per second have shown that in the electric and magnetic field environment of a magnetic-confinement fusion reactor, it is possible to maintain a lithium overlayer which will significantly reduce the copper erosion rate. We have extended these experiments to the reactor-relevant regime of 350 to 400°C, with erosion rates approach-

ing one monolayer per second. By comparison with the lower flux experiments, it is found that radiation damage effects start to dominate both the surface concentration and depth profile of the lithium. The subsurface region of enhanced lithium concentration is broadened, while the surface concentration is not depleted as rapidly per incident ion as in the low flux case. The time-dependent lithium depth profile is calculated using a computer code developed at Argonne which includes both Gibbsian segregation and radiation-induced effects. The experimental results are compared with these calculations. It is found that the sputtering behavior of the copper-lithium alloy is highly dependent on the mass and energy spectrum of the incident particles, the sample temperature, subsurface structure, and the partial sputtering yields of the alloy components.

33626 **(CONF-840604—7) Nonequilibrium segregation and phase instability in alloy films during elevated-temperature irradiation in a high-voltage electron microscope.** Lam, N.Q.; Okamoto, P.R. (Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013423.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

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The effects of defect-production rate gradients, caused by the radial nonuniformity in the electron flux distribution, on solute segregation and phase stability in alloy films undergoing high-voltage electron-microscope (HVEM) irradiation at high temperatures are assessed. Two-dimensional (axially symmetric) compositional redistributions were calculated, taking into account both axial and transverse radial defect fluxes. It was found that when highly focused beams were employed radiation-induced segregation consisted of two stages: dominant axial segregation at the film surfaces at short irradiation times and competitive radial segregation at longer times. The average alloy composition within the irradiated region could differ greatly from that irradiated with a uniform beam, because of the additional atom transport from or to the region surrounding the irradiated zone under the influence of radial fluxes. As a result, damage-rate gradient effects must be taken into account when interpreting in-situ HVEM observations of segregation-induced phase instabilities. The theoretical predictions are compared with experimental observations of the temporal and spatial dependence of segregation-induced precipitation in thin films of Ni-Al, Ni-Ge and Ni-Si solid solutions.

33627 **(CONF-840842—15) Absence of magnetic field dependence of the cyclotron effective masses in Pd.** Joss, W.; Hall, L.N.; Crabtree, G.W.; Vuillemin, J.J. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik; Argonne National Lab., IL (USA); Arizona Univ., Tucson (USA)). Apr 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011721.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The de Haas-van Alphen effect was used to search for a field dependent many-body enhancement of the cyclotron effective mass in Pd, an effect suggested by the experimentally observed depression of the electronic specific heat by a magnetic field. Several orbits on different sheets of the Fermi surface were studied and showed no field dependence in the mass within experimental error. Furthermore, extensive measurements of the mass on the open hole sheet lead to a KKR-parametrized enhanced density of states which differs from the zero field specific heat value by no more than approximately equal -2% rather than approximately equal -15% as estimated earlier. These measurements imply that the large reduction in the linear term of the specific heat by a magnetic field is not due to a suppression of spin fluctuations, a conclusion supported by more recent specific heat experiments.

33628 **(CONF-840842—18) Lattice vibrational behavior of $SnMo_6S_8$ and oxygen defected $SnMo_6S_{7.8}O_{0.2}$.** Kimball, C.W.; Vaishnava, P.P.; Dunlap, B.D.; Fradin, F.Y.; Hinks, D.G.; Shenoy, G.K. (Northern Illinois Univ., Dekalb (USA). Dept. of Physics; Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013453.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The temperature dependence of the Moessbauer effect has been measured at ^{119}Sn sites in oxygen-free, $SnMo_6S_8$ (T/sub c/ = 14.2K) and in oxygen substituted $SnMo_6S_{7.8}O_{0.2}$ (T/sub c/ = 10.1K). The temperature dependence of the asymmetry of the quadrupole doublet for $SnMo_6S_8$ shows phonon anomalies near 50 and 120K. $<z^2>$ /sub T/ indicates contraction with increasing temperature between 4.3 and 50K. For the oxygen substituted compound a study of the variation of mean square displacement with temperature shows lattice softening near 120K.

33629 **(CONF-840842—20) Lattice vibrational behavior of the exchange enhanced superconductor U_6Fe.** Vaishnava, P.P.; Kimball, C.W.; Strelecky, C.A.; Dwight, A.E.; Fradin, F.Y. (Northern Illinois Univ., Dekalb (USA). Dept. of Physics; Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013419.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The temperature dependence of the Moessbauer effect has been studied at ^{57}Fe nuclei in the exchange-enhanced superconductor U_6Fe (T/sub c/ = 3.76+-0.17K). The nonharmonic variation in shift vs temperature is interpreted as due to changes in electronic structure below 100K. Phonon hardening below 100K is also inferred from the temperature dependence of the Debye-Waller factor.

33630 (DOE/ER—0113/3, pp 53-58) **Magnetoresistivity of copper irradiated at 4.4 K by spallation neutrons.** Klabunde, C.E.; Coltman, R.R. Jr. (Oak Ridge National Lab., TN). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

An experiment assembly containing eight differently prepared copper stabilizer specimens was irradiated in the ANL/IPNS-I Radiation Effects Facility. Magnetoresistivity measurements were made on each sample at zero and nine transverse magnetic field strength values up to 6.5 Tesla at each step over three irradiation (4.4 K) and annealing (300 K) cycles. The total neutron fluence was $4.8 \times 10^{21} n/m^2$ ($E > 0.1$ MeV). The results show a strong dependence upon sample purity and state of cold-work. The data from this experiment will be added to a growing body of data to be used in the design of composite superconductors for fusion magnets.

33631 **(DOE/ER/05951—4) Combined thermodynamic study of nickel-base alloys. Final report.** Brooks, C.R. (Tennessee Univ., Knoxville (USA). Dept. of Chemical, Metallurgical and Polymer Engineering). Aug 1983. Contract AS05-78ER05951. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013467.

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A method of making a high temperature, solid electrolyte was developed, and success was achieved in emf measurements on some Ni-Mo and Ni-Mo-Cr alloys. Measurements of the heat capacity of Ni_4Mo from 300 to 1100°K were made, and the construction and testing of a low temperature calorimeter was completed. A computer program to calculate binary phase diagrams from thermodynamic data was written and utilized in analyzing some systems. 13 figures, 6 tables.

33632 (DOE/ER/06035—6) Supersonic metal cluster beams. Technical progress report, March 16, 1983-March 15, 1984. Smalley, R.E. (Rice Univ., Houston, TX (USA)). 1984. Contract AS05-78ER06035. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012976.

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Recent developments in laser and molecular beam technology have now made it possible to produce supersonic beams of metal clusters of virtually any metal in the periodic table. Initially, studies have involved the investigation of the metal-metal bond in transition metal dimers, including Cr_2, Mo_2, V_2, and Ni_2 through resonant two-photon ionization spectroscopy. These studies have demonstrated the importance of 3d (and 4d) electrons in the metal-metal bond in Cr_2, Mo_2, and V_2. A comparison of V_2 and Cr_2 illustrates the importance of the 3d contraction with increasing nuclear charge, and this is found to be of central concern in No_2, where no 3d contribution to the chemical bond is found. Finally, Cu_3 is investigated, providing the first gas-phase spectrum of a triatomic transition metal cluster. Electronically, Cu_3 is analogous to Na_3 and other alkali trimers, so it is not surprising that the observed spectrum is best explained as arising from a Jahn-Teller distorted $^2E'$ state (in D/sub 3h/ symmetry), as has been calculated for Li_3. The observed transition in Cu_3 is assigned to be $^2E''$ reverse arrow $^2E'$, with both upper and lower states undergoing Jahn-Teller distortions.

33633 (DOE/ER/10897—3) Metallic glasses as new catalyst systems for energy conversion. Annual progress report and final technical report. Brower, W.E. Jr.; Smith, G.V. (Southern Illinois Univ., Carbondale (USA)). 31 May 1984. Contract AC02-81ER10897. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013697.

Splat cooled Pd_{80} Si_{20} surfaces are atomically rough and are rich in highly uncoordinated sites approximating kinks in crystalline materials. These sites are only partly destroyed by thermal aging, are not destroyed by cyclic aging in hydrogen, and do not form a β-Pd-hydride phase. Apparently Si imparts to Pd a high resistance towards surface reconstruction, while allowing it to continue to function as Pd in the catalytic sense. Splat cooled $Fe_{80}B_{20}$ can be made glassy, but a sample of Metglas (Allied Chemical $Fe_{80}B_{20}$ No. 2605) was only partly glassy and crystallized at a lower temperature than the shock tube splat cooled glass. These findings are supported by physical, theoretical, and chemical techniques. Physical techniques include x-ray photoelectron spectroscopy, Moessbauer Spectroscopy, and differential scanning calorimetry. Theoretical techniques include surface structural modelling and heat and fluid flow modelling during splat cooling. Chemical techniques include chemisorption of H_2, O_2, and CO as well as the catalytic reactions of alkene and alkyne molecular probes. One of these reactions is the isomerization and hydrogenation of (+)-apopinene.

33634 (EPRI-NP—3483) Fractographic evaluation of specimens of A533B pressure vessel steel. Final report. Toerroenen, K.; Kemppainen, M.; Haenninen, H. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). May 1984. 183p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920383.

This report presents the results of a fractographic evaluation of the specimens from a testing round-robin of environment assisted cyclic crack growth in A533B reactor pressure vessel steel. Results demonstrate that the fracture morphology changes to a brittle-like appearance whenever a significant enhancement of the crack growth rate occurs. It is also shown that manganese sulfide inclusions have a definite role in the environment assisted crack growth process.

33635 (HEDL—7444) Fundamental alloy studies. Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 02 Jul 1984. Contract AC06-76FF02170. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013941.

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A series of four alloy groups have been produced to investigate the origin of swelling and creep resistance in the Fe-Ni-Cr austenitic system and also to explore the possible existence of a high swelling resistance in the corresponding Fe-Cr-Mn austenitic system. This extension is based on a correlation observed between swelling resistance and the analomous property regime commonly referred to as the Invar regime. Many of these alloys have recently been included in irradiation experiments conducted in EBR-II, HFIR and FFTF.

33636 (HEDL—7451) Effective thermophysical and elastic properties of materials with voids. Wolfer, W.G.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 02 Jul 1984. Contract AC06-76FF02170. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013942.

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The current theories describing the influence of void swelling on conductive and elastic properties have been reviewed and compared with the limited data available. Judgements have been made as to the most appropriate equations to describe the influence of voidage on thermal and electrical conductivity, and also the shear, bulk and Young's moduli and Poisson's ratio. These equations will be included in the Fusion Materials Handbook.

33637 (HMI-B—390) Computeraided measurement of electric resistances of metals irradiated with electrons. Poerschke, R.; Herdam, G. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik). Mar 1983. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751494.

The measurement of electric resistances of metals and alloys before, during and after irradiation with electrons of high energy is controlled by a CAMAC-processor in a stand-alone measurement instrumentation system. The chosen measurement procedure permits a relative exactness of the resistance values 10^{-5} by reversing the polarity of the measurement current and performing series measurements with positive and negative direction of current. During irradiation, the development of the resistance values is plotted on the terminal. All measurement results and all intermediate values are recorded on a tape of a connected DECtape II for later evaluation.

33638 (INIS-BR—107, pp 73) Reaction field approximation for two non-equivalent interacting sub-lattices of atomic spins. Cassol, T. (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33639 (INIS-BR—107, pp 17-18) Ion implantation laboratory. Zawislak, F.C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33640 (INIS-BR—107, pp 19) Radiation-enhanced diffusion as a coating method for protection against corrosion and wear. Baumvol, I.J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33641 (INIS-BR—107, pp 19-20) Influence of Tin implantation on the oxidation of iron. Baumvol, I.J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33642 (INIS-BR—107, pp 20-21) **Nitriding of steels: Conventional processes and ion implantation.** Santos, C.A. dos (Rio Grande do Norte Univ., Natal (Brazil). Dept. de Fisica Teorica e Experimental); Baumvol, I.J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33643 (INIS-BR—107, pp 22-23) **Iron nitride and carbonitride phases in a nitrogen implanted carbon steel.** Santos, C.A. dos (Rio Grande do Norte Univ., Natal (Brazil). Dept. de Fisica Teorica e Experimental); Barros Junior, B.A.S. de; Souza, J.P. de; Baumvol, I.J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33644 (INIS-BR—107, pp 23-25) **Composition and thermal evolution fo nitrogen implanted steels: A systematic study.** Santos, C.A. dos (Rio Grande do Norte Univ., Natal (Brazil). Dept. de Fisica Teorica e Experimental); Behar, M.; Souza, J.P. de; Baumvol, I.J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33645 **(INIS-BR—108) Effect of the joint clearance in the welding properties of austenitic stainless steel brazed at high temperature.** Silva, E.G. da; Alvisi, P.P.; Bussinger, S.M.; Cardoso, P.E. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1981. 20p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780336.

By metallographic, microhardening and tension tests, the effects of joint clearance in the precipitation of fragile phases, and its relation with the mechanical properties of the brazed joints at the temperature of 1010°C, are investigated.

33646 (INIS-BR—119, pp 101-102) **Phase transformations and microstructures of Fe-Nb, Fe-Nb-Mn, Fe-Nb-Mn-Cr alloys of high iron content.** Silva, B.F. da; Silva Costa, M.A.Z. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)); Ferran, E.M. de; Barbabela, G.D. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33647 (INIS-BR—119, pp 95-96) **Study of the components taken from sodium loop.** Barone, S.D.; Santos, R.M.M.; Gaio, J.C.; Alves, P.R.; Lima, R.M.G.; Coutinho, J.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33648 (INIS-BR—119, pp 96) **Inspection realized in a propeller blade fractured during normal operation.** Andrade, E.G. de; Albuquerque Lima, M. de; Ramos, P.R. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33649 (INIS-BR—119, pp 96) **Inspection realized in steel large whip fractured during normal operation.** Andrade, E.G. de; Albuquerque Lima, M. de; Ramos, P.R. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33650 (INIS-BR—119, pp 97) **Analysis of AISI 316-L stainless steel welded plates.** Andrade, E.G. de; Barone, S.D.; Lima, R.M.G. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33651 (INIS-BR—120, pp 199) **Fabrication of thorium and uranium thin targets by molecular electrodeposition.** Souza, M.I.S. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33652 **(INIS-mf—8389) Investigations on crack formation in fatigue slip bands.** Hunsche, A. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 29 Jun 1982. 74p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780256.

The aim of this study was to reproduce the surface topography of metals at cyclic loads as well as its variation with time by means of modern methods and to investigate it. Particular attention was given to the statistical support of the quantitative results by sufficiently large samples. This requires the development of preparation methods that are simple and can be quickly carried out. The material chosen was copper, because a particularly extended information background is available there. (orig./RW).

33653 (INIS-mf—8903, pp 129-132) **Analysis of the hydrogen absorption in the U(Alsub(x)Nisub(1-x))$_2$ system.** Biderman, S.; Jacob, I.; Hadari, Z. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Nuclear Engineering); Mintz, M.H. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33654 (INIS-mf—8921, pp 76) **NMR study of hydrogen in cathodically charged Inconel 718.** Raizman, A.; Barak, J.; Zamir, D.; Eliezer, D. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

Published in summary form only.

33655 (INIS-mf—8928, pp 240-261) **Weldability study for 13/6/0.5 CrNiMo type steel.** Slysko, P. (Vyskumny Ustav Zvaracsky, Bratislava (Czechoslovakia)). 1981. (In Slovak). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780241. (CONF-8112102—Vol.1).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The testing of susceptibility of steel to hot tears was carried out by simulation of heat deformation cycles using the Thermorestor-W equipment in the stage of heating and cooling. The mechanical properties of steel were tested after diverse tempering. The susceptibility was tested to cold tears below the weld bead after simulation of cycles of welding and using the technological Tekken and Lehigh tests. High susceptibility was found to hot tears. On the fracture surface of hot tears, excluded eutectic TiX carbides and sulfides were found and in some places nests of $M_{23}D_6$. Maximum plastic properties were attained after heat treatment. The suscepti-

bility to cold tears was only found using one of the test methods. (M.D.).

33656 (INIS-mf—8928, pp 283-295) **Assessing susceptibility to liquation and annealing cracks in weld metals used in power engineering.** Magula, V. (Vyskumny Ustav Zvaracsky, Bratislava (Czechoslovakia)). 1981. (In Slovak). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780241. (CONF-8112102—Vol.1).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

Susceptibility to annealing and liquation tears during manual arc welding and submerged arc welding was studied in weld materials 8505, A 324, A 343, MnNiMoCr and Sv10KhMFT. The tests were carried out using the method of simulation of deformation welding cycles. For the evaluation, the isothermal tensile test and the shortened creep test were used. In the study of fracture surfaces of annealing hot tears, the presence was found of Fe_3O_4 and Fe_2O_3 and sulfides. The criteria of crackability for steels are adequate even for weld metals. All studied weld metals were assigned the 2nd degree of susceptibility, i.e., steels susceptible to liquation tears which may be prevented by the observance of prescribed conditions during welding. (M.D.).

33657 (INIS-mf—8929, pp 30-40) **Assessing properties of stainless steel for valves used in nuclear power plants.** Tvrdy, M.; Hyspecka, L. (Vitkovicke Zelezarny Klementa Gottwalda, Ostrava (Czechoslovakia). Vyzkumny Ustav Metalurgicky); Mazanec, K. (Vysoka Skola Banska, Ostrava (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PG A05/MF A01. Order Number TI84780242. (CONF-8112102—Vol.2).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

The results are summed up of the evaluation of the mechanical and metallurgical properties of low-carbon stainless martensitic-austenitic steels, alloyed with 13% Cr and 4 to 6% Ni with the addition of molybdenum. Used for the investigation were laboratory melts, rolled and cast and operating melts in form of actual castings. It was found that during optimal treatment it is possible to attain the required resistance to brittle fracture, hydrogen embrittlement and intercrystalline corrosion and the favourable character of the temperature dependence of notch toughness. (M.D.).

33658 (INIS-mf—8929, pp 41-50) **Hydrogen effect on properties of Cr-Mo-V steel.** Splichal, K.; Otruba, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780242. (CONF-8112102—Vol.2).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

Hydrogen embrittlement was studied of Cr-Mo-V steel designed for the manufacture of WWER pressure vessels. Hydrogen embrittlement is manifested at the hydrogen content of over 2.5 ppm by a significant reduction in contraction, ductility, fracture stress, change in the micromechanism of fracture and at a higher content of hydrogen by cracks. Fractographic observations showed that as a result of hydrogen, brittle fracture occurs, the dominant mechanism of the failure is quasi-fission. No effect of neutron irradiation on the mechanism of the fracture was observed. (M.D.).

33659 (INIS-mf—8929, pp 94-103) **Conditions of crack propagation in steel with austenitic overlay at variable load.** Linhart, V. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780242. (CONF-8112102—Vol.2).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

15Kh2MFA steel with an austenitic CrNi weld deposit was investigated. The threshold values for the development of cracks in the free overlay layer are lower than the values for base steel. Threshold values significantly depend on the parameter of asymmetry of variable strain. The development of fatigue cracks in the overlay metal is several times faster than in base steel, as is the development of the surface crack under the overlay area. Its development accelerates rapidly when the crack penetrates from the base material to the overlay. (M.D.).

33660 (INIS-mf—8929, pp 128-141) **Assessing fatigue characteristics of austenitic CrNi steel used for components of light water reactor power plant.** Matocha, K.; Tvrdy, M.; Hyspecka, L. (Vitkovicke Zelezarny Klementa Gottwalda, Ostrava (Czechoslovakia). Vyzkumny Ustav Metalurgicky); Mazanec, K. (Vysoka Skola Banska, Ostrava (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780242. (CONF-8112102—Vol.2).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

A complex analysis is presented of the mechanical and metallurgical properties of 0Kh18N10T and 0Kh18N12T steels. A physical and metallurgical analysis was made of the different methods of treatment. The conditions of initiation and the development of fatigue cracks were studied for low-cycle fatigue at temperatures of 20 degC and 325 degC and with the evaluation of corrosion fatigue. (M.D.).

33661 (INIS-mf—8934, pp 26-27) **Moessbauer spectroscopy measurements of the magnetic properties of oriented SiFe sheets.** Slama, J.; Prejsa, M. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia)). Jul 1983. NTIS (US Sales Only), PC A18/MF A01. Order Number TI84780273. (CONF-8309217—Absts.).

From 6. European conference on soft magnetic materials; Eger, Hungary (6 Sep 1983).

33662 (INIS-mf—8934, pp 98) **Moessbauer studies in $Fe_{40}Ni_{40}P_{14}B_6$ and $Fe_{40}Ni_{38}Mo_4B_{18}$ metallic glasses.** Rao, I.K.; Raju, S.B. (Andhra Univ., Waltair (India). Dept. of Physics). Jul 1983. NTIS (US Sales Only), PC A18/MF A01. Order Number TI84780273. (CONF-8309217—Absts.).

From 6. European conference on soft magnetic materials; Eger, Hungary (6 Sep 1983).

33663 (INIS-mf—8934, pp 292-293) **Comparison of the magnetic relaxation spectra in α-Fe following low-temperature electron and neutron irradiation.** Blythe, H.J. (Sheffield Univ. (UK). Dept. of Physics); Walz, F. (Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.). Inst. fuer Physik); Dworschak, F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Jul 1983. NTIS (US Sales Only), PC A18/MF A01. Order Number TI84780273. (CONF-8309217—Absts.).

From 6. European conference on soft magnetic materials; Eger, Hungary (6 Sep 1983).

33664 **(INIS-mf—8934) Proceedings of the 6th European conference on soft magnetic materials held at Eger, 6-9 September 1983.** Thomas, G. (ed.). (European Physical Society, Geneva (Switzerland)). Jul 1983. 401p. (CONF-8309217—Absts.). NTIS (US Sales Only), PC A18/MF A01. Order Number DE84780273.

From 6. European conference on soft magnetic materials; Eger, Hungary (6 Sep 1983).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

33665 **(INIS-mf—8942) Laser induced fluorescence measurements on atoms with low energies.** Thomsen, K. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). 1982. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780388.

In recent measurements of velocity spectra of sputtered atoms using the Doppler-shift laser fluorescence spectrosocopy several problems have been encountered concerning the interpretation of the obtained fluorescence spectra. Essential to the interpretation

of the measured spectra is the knowledge of whether the signal is proportional to the flux or to the density of the sputtered particles in the energy region under consideration. Investigations of this problem at low particle velocities in the thermal energy region are discussed for thermal sodium beams, because in this case the theoretical distribution is well known. It was found that in the low energy region the fluorescence signal is proportional to the flux. Deviations of the measured spectra at energies below 1 eV from the theoretically expected shape according to the linear cascade theory by Sigmund have been attributed to several different mechanisms: a) choice of a spherical surface barrier instead of a planar surface barrier as usually applied in linear cascade theory, b) thermal evaporation for materials like alkali halides, c) spikes as proposed by Szymonski et al. A further problem arises with the interpretation of spectra at very low velocities. Power broadening which can cause the spectra to extend to 'negative velocities' using a pulsed laser for excitation is discussed and was found to be negligible for the measurement of energy spectra of sputtered species using a cw-dye laser with intensities up to 500 mW/cm^2. It could be shown that the existence of particles with negative velocities is linked to the contribution of linear collision cascades to the total flux. (Author).

33666 (INIS-SU—198, pp 520) **Observing electron-phonon interaction in (SnTe)sub(x)(PbSe)sub(1-x) system with Moessbauer spectroscopy.** Baltrunas, D.I.; Moteyunas, S.V.; Starik, P.M.; Mikityuk, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

33667 (INIS-SU—211, pp 8-12) **Proton radiation effects on structural material properties at charged particle accelerators.** L'vov, A.N.; Sidorenko, I.S.; Khizhnyak, N.A.; Shilyaev, B.A.; Yamnitski , V.A. 1982. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI84780255.

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In Technique of physical experiment.

Materials of structure elements of high-current proton accelerator and types of nuclear reactions on the protons lost in the process of acceleration, are determined. The relative defect forming ability of protons calculated relatively to neutrons of thermonuclear reactor (14 MeV) and BOR-60 reactor for 13 metals from Be to U is almost linear with the growth of the element number in the periodic system and changes from 8 (for Be) to 200 (for U), in the surface range (or up to 60 for Esub(n)=14 MeV). Radiation change of Nb_3Sn stoichiometric composition is found for protons only: starting from the fluence approximately 10^{24} prot/cm^2 a noticeable formation of Nb_6Sn_5 phase is possible which brings about a considerable decrease of temperature of transition to a superconducting state (approximately up to 1 K) and the reject of the superconducting element.

33668 (INIS-SU—222, pp 3-12) **Hyperfine interactions and radiation damage in metals.** Kirichenko, V.C.; Chekin, V.V. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Reznichenko, Eh.A. 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

The review of the works carried out up to 1980 is given. They are based on the local characteristics of metal irradiation damage studied by the methodics which registrate hyperthin interaction (HTI). These investigations are divided in three groups. I.n the first group HTI of the implanted atom excited nucleus with the nearest neighbours in the created collision cascade are studied. The second group is the study of impurity nuclei implanted into metal by usual metallurgical methods and nuclei interaction with the nearest surroundings Under the outside irradiation and thermonuclear treatment. The third group unites the investigations of radiation damage influence on electronic structure and oscillation dynamics of matrix atoms of the irradiated metal. The main results are obtained by nuclear gamma resonance on ^{57}Fe nuclei.

33669 (INIS-SU—222, pp 46-50) **Segregation theory in alloys under irradiation.** Akhiezer, I.A.; Davydov, L.N. 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

The segregation mechanism kinetics is considered in the irradiated alloys at the presence of non-Uniformity: mechanical stresses nonuniformely distributed vacancies or interstitials temperature non-uniformity. The role of complexes impurity atom- point defect (vacancy or interstitial) in alloy segregation is analysed. A question on nucleation of mixed clusters containing vacancies and impurity atoms is discussed. The problem on non- coherent impurity precipitation ou of the irradiated unsaturated solid solution was studied.

33670 **(INIS-SU—222) Physics of radiation damage and radiation material science.** (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 105p. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780272.

Abstracts of individual items from the report were prepared separately for the data base. (GHT)

33671 **(IS-M—480) Conduction electron density of states and proton spin-lattice relaxation in the dihydrides of Sc, Y, La, and Lu.** Torgeson, D.R.; Lu, L.T.; Phua, T.T.; Barnes, R.G.; Peterson, D.T.; Seymour, E.F.W. (Ames Lab., IA (USA); Warwick Univ., Coventry (UK). Dept. of Physics). 1984. Contract W-7405-ENG-82. 3p. (CONF-8404106—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014123.

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

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Measurements of the proton spin-lattice relaxation time T_1 are frequently utilized as a basis for estimating the electronic density-of-states (d.o.s.) at the Fermi level, N(E/sub F/), and its dependence on hydrogen concentration, alloy composition, etc., in metal hydrides. This follows from the fact that quite generally the Korringa product T_1/sub e/T (where T_1/sub e/ is the electronic contribution to the measured T_1) is related to N(E/sub F/) by (T_1/sub e/T)/sup -1/2/ proportional to N(E/sub F/). At low temperatures where hydrogen diffusion is negligible, the measured relaxation rate $R_1 = (T_1)$/sup -1/ is expected to be given by $R_1 = R_1$/sub e/ + R_1/sub p/ where R_1/sub e/ = (T_1/sub e/)/sup -1/ and R_1/sub p/ is the relaxation rate due to proton spin diffusion to paramagnetic impurity ions present in the metal. The determination of R_1/sub e/ from measured values of R_1 thus also involves the determination or estimation of R_1/sub p/. As shown recently, the presence of RE impurities at levels as low as 10 parts-per-million (ppM) can produce significant effects. We report determinations of proton T_1/sub e/T in the dihydride phases of Sc, Y, La, and Lu based on samples prepared from the highest purity metals available in the Ames Laboratory and in addition in some cases utilizing the technique of partial deuteration to further suppress the paramagnetic contribution R_1/sub p/.

33672 **(IS-T—1140) Superconductivity in ternary rare earth palladium Heusler compounds.** Johnson, M.J. (Ames Lab., IA (USA)). Jun 1984. Contract W-7405-ENG-82. 57p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013983.

Thesis.

A study of the ternary rare earth palladium Heusler compounds of composition RPd_2X, where R=Sc, Y, Er, Tm, Yb, or Lu, and X=Sn or Pb, was undertaken to investigate the behavior of their superconducting transition temperature under pressure. The transition temperature was linearly depressed to 20 kbar, with dT/sub c//dP typically of the order of 10^{-5} K/bar, which can be explained by a stiffening of the simple cubic palladium sublattice with increasing pressure. The lattice parameter and transition temperature are very disorder-dependent, increasing to maximum values after annealing for two days; resistivity measurements indicate that no phase transitions occur below room temperature.

33673 **(KFK—3628) Exact solutions of rate equations for the calculation of supersaturations of defects and growth rates for voids.** Heidenreich, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1983. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751445.

Exact solutions of the rate equations are discussed in detail for vanishing and nonvanishing recombination coefficient α. The existence and uniquenes of the solutions are shown for arbitrary sources and sinks and for α not= o.

33674 **(KFK—3651) X-ray investigation of Nb3Ge under high pressure.** Schneider, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). Dec 1983. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751447.

The compressional behaviour of A15-superconductors was investigated in a diamond anvil apparatus using energy dispersive X-ray diffraction at pressures up to 120 kbar and temperatures between 300 K and 4 K. A pronounced anomaly in the pressure dependence of the lattice spacing was observed in the case of the high-Tc superconductors based on Niobium at 78 K and 4 K. This anomaly can be explained by a periodic sublattice displacement of the Niobium atoms together with tetragonal symmetry.

33675 **(LA-UR—84-889) Pressure-dependent resistive behavior of $YbBe_{13}$.** Thompson, J.D.; Fisk, Z.; Willis, J.O. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010068.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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We have studied the effect of hydrostatic pressures up to 16 kbar on the temperature-dependent resistance of $YbBe_{13}$. Anomalies in the low-temperature resistance are discussed in terms of an antiferromagnetically ordered ground state and resonant scattering off thermally populated crystalline electric field levels. A comparison is made to the resistive behavior of UBe_{13}. We find no evidence for superconductivity in $YbBe_{13}$ above 0.08°K.

33676 **(LA-UR—84-1019) Initial slope of the upper critical field of the heavy fermion superconductor UPt_3.** Willis, J.O.; Fisk, Z.; Smith, J.L.; Chen, J.W.; Lambert, S.E.; Maple, M.B. (Los Alamos National Lab., NM (USA); California Univ., San Diego, La Jolla (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009980.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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We have made low field measurements of the upper critical field as a function of temperature for all parallel and perpendicular configurations of magnetic field H, current I, and crystallographic orientation for UPt_3, the heavy fermion superconductor. The curves are quite linear for H parallel I, with slopes of -4.0 T/K for I in the basal plane and -6.3 T/K for I along the c-axis. For H perpendicular I the curves are concave upward near H = 0 and have a generally smaller slope than for the same field applied parallel to the current.

33677 **(LA-UR—84-1051) Dynamics of normal-zone propagation in Ta at small currents.** Overton, W.C. Jr.; Weinstock, H. (Los Alamos National Lab., NM (USA); Illinois Inst. of Tech., Chicago (USA). Dept. of Physics). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009990.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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In normal-zone propagation in thin wires embedded in LHe, the velocity of the N-S interface is strongly influenced by heat conductance to the bath. We observe, as usual, the frontal N-S interface propagation at constant velocity. However, for small currents near the critical value, healing of the N-zone back to the S-state occurs, thus forming a propagating S-N interface the velocity of which oscillates in time. We discuss the dynamics of this new phenomenon.

33678 **(LA-UR—84-1053) Thermomagnetic properties of GdPd.** Barclay, J.A.; Overton, W.C. Jr.; Zimm, C.B. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009991.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The magnetic susceptibility, magnetization, and field-dependent heat capacity of ferromagnetic GdPd have been measured. The magnetic moment of the Gd spin obtained from the saturation magnetization at 4.2°K is enhanced over the free Gd value. The heat capacity shows a large lambda-type magnetic anomaly at the Curie temperature of 40.0 + 0.5°K.

33679 **(LA-UR—84-1203) Low temperature properties of $CeOs_2$.** Torikachvili, M.S.; Maple, M.B.; Meisner, G.P. (California Univ., San Diego, La Jolla (USA). Inst. of Pure and Applied Physical Sciences; Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—13). NTIS, PC A02; 3; GPO Dep. Order Number DE84011333.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The binary compound $CeOs_2$ has been prepared in both cubic C15 and hexagonal C14 Laves phases. Measurements of ac magnetic susceptibility, electrical resistivity and specific heat have been performed on both phases. The C14 phase has been found to exhibit superconductivity with a superconducting transition temperature T/sub c/ of 1.1°K.

33680 **(LBL—17237) Effect of surface doping on the oxidation of chromia former alloys.** Landkof, M.; Boone, D.H.; Gray, R.; Levy, A.V.; Yaniv, E. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 62p. (CONF-840405—13). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013390.

From NACE corrosion '84 international forum and exhibition; New Orleans, LA, USA (1 Apr 1984).

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Y, Ce, La, Hf, Ca, and Zr were applied to the surfaces of type 304 and 310 stainless steels and IN 738, a nickel base alloy. In order to determine the effect of the minor alloying elements in stainless steels on the surface doping effect, Y was applied to three alloy modifications of type 304SS. The presence or absence of Mn and Si in the alloy on the high temperature corrosion behavior was determined. Several different doping techniques were used to determine which technique was most beneficial to the behavior of the oxide barrier scale. The application of Y, Ce and La was found to enhance the oxidation resistance of the commercial stainless steels while no benefits were found for alloys doped with Hf, Ca and Zr. It was determined that Si had to be present in the type 304 SS for the doping process to enhance the oxidation resistance. There was no beneficial effect on modified 304SS containing Mn only or without Mn or Si. The yttrium doped and undoped modified type 304SS with Si only showed more resistance to scale spallation than any other type 304SS alloy tested, either commercial or modified. 21 figures, 11 tables.

33681 **(SAND—84-8003) Evaluation of the effects of current impulses in a side bonding resistance forge weld.** Formisano, B.D. (Sandia National Labs., Livermore, CA (USA)). Jun 1984. Contract AC04-76DR00789. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013570.

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Results of this study show that the temperature, displacement, and bond length increase rapidly during the first two pulses of current, and change very little thereafter. The study also re-

vealed that the plug bottoms out inside the conical hole after the second pulse of current. This indicates that with this particular joint design the process is insensitive to the time duration of current flow beyond two current pulses. After the second current pulse the bond length tends to level off dramatically with little increase thereafter. One could conclude that after the second current pulse the additional three pulses do little to enhance the weld quality. However, the last three pulses did not degrade the quality of the weld.

33682 **Model for the transition in the oxidation of zirconium-base alloys.** Dollins, C.C.; Berquist, B.M. (Bettis Atomic Power Lab., West Mifflin, PA (USA)); Jursich, M. (Control Data Corp., Minneapolis, MN (USA)). *Radiation Effects;* **79**: No. 1-4, 265-273(Dec 1983).

At a weight gain of approximately 20 to 30 mg/dm² during the oxidation of zirconium-base alloys at reactor operating temperatures the oxidation rate accelerates. This is the so-called transition. A mechanistic model has been developed to describe the transition based on the growth and interconnection of small pores along the oxide-metal interface. Once the pores interconnect, coolant can reach the oxide-metal interface and oxidation accelerates. The model has been programmed and incorporated into the previously reported oxidation model. Good agreement has been obtained between the model predictions and experimental data.

33683 **Field-ion microscopy study of ion damage to tungsten.** Farnum, D.J.; Inal, O.T. (New Mexico Inst. of Mining and Technology, Socorro (USA)); Walko, R.J. (Sandia National Labs., Albuquerque, NM (USA)). *Physica Status Solidi [Sectio] A: Applied Research;* **80**: No. 1, 287-303(16 Nov 1983).

The effects of low energy in-situ ion bombardment of tungsten field ion emission surfaces are studied using various ion energies and plasmas produced from pure hydrogen, deuterium, neon, and argon gases. The results show that the average void size and depth of damage increase with ion energy, atomic weight, and ion dosage (the total number of ions to strike the tip per unit area). Sputtering occurs in most samples. In general the highest sputtering damage is observed along the close packed <111> directions.

33684 **Theory of small clusters of helium in metals.** Wilson, W.D. (Sandia National Labs., Albuquerque, NM (USA)). *Radiation Effects;* **78**: No. 1-4, 11-24(Nov 1983). (CONF-820952—).

From International symposium on helium in metals; Juelich, F.R. Germany (21 Sep 1982).

The development of the atomistic theory of small clusters of helium in metals is briefly reviewed with particular regard to the necessary interatomic potentials. The activation energy for interstitial helium motion is then calculated using He-Ni potentials which vary in their derivation from empirical to quantum mechanical (including the effects of the solid). Additional comparisons are made for single helium associated defects in Al where results using metal-metal potentials derived from pseudopotential theory and by empirical means are shown to give rise to only negligible differences. Finally, the theory is applied to the self-trapping of helium in metals, the formation of helium bubbles and associated self-interstitial loops.

33685 **Experimental studies of helium in metals.** Thomas, G.J. (Sandia National Labs., Livermore, CA (USA)). *Radiation Effects;* **78**: No. 1-4, 37-51(Nov 1983). (CONF-820952—).

From International symposium on helium in metals; Juelich, F.R. Germany (21 Sep 1982).

A short review is given of recent experimental studies of helium in metals, emphasizing fundamental He behavior at low temperatures (room temperature and below), low He concentrations (approx. 1 at.% He) and in the absence of radiation induced defects. Some of the main points are: (a) interstitial He is generally locally mobile at room temperature and below, (b) impurities behave as strong unsaturable traps which lose their identity with increasing numbers of trapped He atoms, and (c) the eventual microstructure of He charged metals appears qualitatively the same in pure undamaged materials as in radiation-damaged materials.

33686 **Release of ion-implanted and transmutation-produced helium from nickel.** Poker, D.B. (Oak Ridge National Lab., TN (USA)). *Radiation Effects;* **78**: No. 1-4, 101-104(Nov 1983). (CONF-820952—).

From International symposium on helium in metals; Juelich, F.R. Germany (21 Sep 1982).

Measurements of He release were performed on Ni samples doped by thermal neutron irradiation or ion implantation. Closed and open cylinders of Ni were neutron irradiated at 100 deg C. The amount of He released into the interior of the closed cylinders was equivalent to that produced in the volume of Ni within about 0.5 μm of the surface, indicating some mobility of He at room temperature. The open cylinders were heated in vacuum while the He release was measured. Below 1000 deg C, the amount of He released was equivalent to that produced within 0.02 μm of the surface. Surface evaporation could account for the He release at higher temperatures. Upon melting the Ni, all the remaining He was released. He release from Ni at temperatures between 18 and 600 K was measured after ion implantation of 35 keV He^+ at 18 K. The only significant release was sharply peaked near 50 K. Results presented here on Ni and Cu indicate that the 50 K release does not originate from the metal, but from a carbon surface film which is formed during the implantation. Similar releases were observed following implantations of He into graphite and solid methane.

33687 **Multifilamentary superconducting (NbTa)-Sn composite wire by solid-liquid reaction for possible application above 20 tesla.** Hong, M.; Hull, G.W. Jr.; Fuchs, E.O.; Holthuis, J.T. (Bell Laboratories, Murray Hill, NJ). *Materials Letters;* **2**: No. 2, 165-168(Oct 1983).

Nb alloyed with Ta was employed in fabricating multifilamentary composite wires of (NbTa)-Sn using the liquid-infiltration process. The superconducting A15 phase was formed with subsequent heat treatments at 800-950°C by the solid-liquid reaction. High inductive Tsub(c)'s of 18.2 K with sharp transition width (<0.3 K) and high overall Jsub(c)'s of approx. 1.6 X 10^4 A/cm² at 20 T and 4.2 K were obtained. It was found that 2 wt.% Ta in the Nb was sufficient in the enhancement of the overall Jsub(c) at the high fields and in increasing the Hsub(c2) (4.2 K) to 25 T.

33688 **Microstructure and mechanical properties of precipitation hardened aluminum under high rate deformation.** Grady, D.E.; Asav, J.R.; Rohde, R.W.; Wise, J.L. (Sandia National Lab. Albuquerque, NM). pp 81-100 of Material behavior under high stress and ultrahigh loading rates. Vol. 29. Mescall, J.; Weiss, V. New York, NY; Plenum Publishing Corp. (1983). (CONF-820725—). Contract AC04-76DP00789.

From 29. annual Sagamore Army materials research conference; Lake Placid, NY, USA (19 Jul 1982).

This chapter attempts to correlate the shock compression and quasistatic deformation of 6061-T6 aluminium. Examines recovered specimens which have been shock loaded, and compares results with both static and dynamic mechanical property measurements. Discusses experimental procedures (reshock and unloading experiments, shock recovery techniques, metallographic techniques and coldwork experiments); dynamic strength and wave-profile properties (strength and shear-stress states on the Hugoniot, steady-wave risetime and viscosity); quasistatic and shock metallography studies (metallography of quasistatically deformed material; metallography of shock deformed specimens; comparison of static and shock deformation; correlation of hardness and dynamic strength measurements); and thermal trapping calculations in shocked aluminium (heterogeneous deformation and adiabatic heating in shock-wave loading; energy and risetime relations under steadywave shock compression; heterogeneous temperature calculations in aluminium). Concludes that heterogeneous shear deformation appears to play a role in the dynamic deformation process.

33689 Materials response to large plastic deformation. Stout, M.G.; Hecker, S.S. (Materials Science and Technology Division Los Alamos National Lab. Los Alamos, NM). pp 39-60 of Material behavior under high stress and ultrahigh loading rates. Vol. 29. Mescall, J.; Weiss, V. New York, NY; Plenum Publishing Corp. (1983). (CONF-820725—).

From 29. annual Sagamore Army materials research conference; Lake Placid, NY, USA (19 Jul 1982).

This chapter addresses the influence of deformation mode, crystal structure, material purity, and alloying on stress-strain behavior. Focuses on low strain rate data but attempts to show trends which are also important for large strain, high strain rate predictions. Examines experimental techniques, aluminium and aluminium alloys, copper, nickel, 70-30 brass, and bcc iron and iron alloys. Points out that strain hardening at large plastic strains cannot be inferred from small-strain tensile tests. Finds that saturation (steady state behavior) of the flow stress in fcc materials is not universal. Notes that most metals and alloys at room temperature do not reach steady state saturation at strain levels of 3 to 5.

33690 Thermal conductivity and Lorenz number of plutonium and plutonium-gallium alloys. Andrew, J.F.; Klemens, P.G. (Los Alamos National Lab. Los Alamos, NM 87545). pp 209-218 of Thermal conductivity. Vol. 17. Hust, J.G. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106164—).

From National Bureau of Standards joint conferences: 8. symposium on thermophysical properties; 17. thermal conductivity conference; 8. thermal expansion conference; Gaithersburg, MD, USA (15 Jun 1981).

This chapter presents the results of thermal diffusivity measurements of Pu, Pu-2.7 at.% Ga, Pu-3.5 at.% Ga, and Pu-6.6 at.% Ga from 25°C to around 500°C using a laser flash technique and electronic data acquisition. Finds that although the Lorenz number, L, of pure Pu is well below the Sommerfeld value, L /SUB o/ , except for the α-phase, L exceed L /SUB o/ for the alloys at all temperatures and has a pronounced minimum around 200°C. Attributes the excess at the lower temperatures to lattice conduction and the excess at temperatures above 200°C is attributed to an electronic component. Ascribes the negative deviation of L from L / SUB o/ for pure Pu to a reduction of the electron mobilities in those energy ranges where the 5f bands overlap the conduction bands.

33691 The physical properties of 9 Cr-1 Mo steel from 300 to 1000 K. Williams, R.K.; Graves, R.S.; McElroy, D.L.; Weaver, F.J. (Metals & Ceramics Division Oak Ridge National Lab. Oak Ridge, TN 37830). pp 219-228 of Thermal conductivity. Vol. 17. Hust, J.G. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106164—). Contract W-7405-ENG-26.

From National Bureau of Standards joint conferences: 8. symposium on thermophysical properties; 17. thermal conductivity conference; 8. thermal expansion conference; Gaithersburg, MD, USA (15 Jun 1981).

This chapter studies the thermal conductivity and expansion of an improved 9 Cr-1 Mo steel. Points out that the mechanical properties of 9 Cr-1 Mo steel can be significantly improved by heat-treating material that contains small additions of the carbide-forming elements V and Nb. Shows that the electron and phonon thermal conductivity components are both quite sensitive to Si content. Finds that the thermal expansion of standard commercial material is indistinguishable from that of the improved alloy.

33692 Theory of radiation-induced segregation. Wiedersich, H.; Lam, N.Q. (Argonne National Lab., IL (USA)). pp 1-46 of Phase transformations during irradiation. Nolfi, F.V. Jr. (ed.). Barking, England; Applied Science Publishers Ltd. (1983).

In this paper we review the basic knowledge of the mechanisms involved in radiation-induced segregation and discuss models and model calculations that describe the process. The next section presents a short, qualitative description of the segregation process which requires the existence of persistent defect fluxes and their preferential coupling to the fluxes of alloying components. The causes of the preferential coupling are attractive interactions between defects and some alloying elements, and/or preferential migration of defects via atoms of some alloy components. In dilute alloys, the interactions can be described by vacancy-solute and interstitial-solute binding, i.e. the formation of defect-solute complexes; the preferential migration can include complex migration as well as preferential defect migration via solute or solvent atoms. Section 3 gives an overview of point-defect solute interactions in dilute alloys and their effects on solute fluxes. The coupling of defect and atom fluxes to composition and defect concentration gradients in concentrated alloys is discussed in Section 4. The phenomenological equations describing the segregation process are formulated, and the computational formalism to obtain time-dependent solutions to the phenomenological equations is outlined in Section 5. Some model calculation results are discussed in Section 6.

33693 Effects of irradiation on diffusion in metals and alloys. Rothman, S.J. (Argonne National Lab., IL (USA)). pp 189-211 of Phase transformations during irradiation. Nolfi, F.V. Jr. (ed.). Barking, England; Applied Science Publishers Ltd. (1983).

Diffusion via the motion of radiation-induced point defects is well understood for simple systems, and satisfactory agreement between theory and experiment is obtained. For complicated systems, our understanding is qualitative, as more phenomena come into play. Equations for analyzing some aspects of the problem exist, but numerical values for the necessary atomic-defect parameters, especially those that deal with interstitials, are not well known. In addition to its importance in nuclear technology, radiation-enhanced diffusion also enters into ion-beam technology.

33694 Non-equilibrium segregation in irradiated alloys. Rehn, L.E.; Okamoto, P.R. (Argonne National Lab., IL (USA)). pp 247-290 of Phase transformations during irradiation. Nolfi, F.V. Jr. (ed.). Barking, England; Applied Science Publishers Ltd. (1983).

Experimental observations of radiation-induced segregation in four model binary alloy systems are reviewed in the present paper. The systems are Ni-Si and Ni-Sb, in which strong enrichment of the undersize solute (Si) and depletion of the oversize solute (Sb) occur at defect sinks, Cu-Ni, in which enrichment of the undersize component of a highly concentrated alloy occurs at sinks, and Ni-Ge, in which the observed direction of segregation is in violation of the size-effect correlation. Quantitative measurements of composition as a function of depth in the near-surface region reveal that several qualitative features of radiation-induced segregation are common to all four alloy systems.

33695 Implications of radiation-induced segregation and phase instability on alloy design. Bloom, E.E.; Stiegler, J.O. (Oak Ridge National Lab., TN (USA)). pp 331-355 of Phase transformations during irradiation. Nolfi, F.V. Jr. (ed.). Barking, England; Applied Science Publishers Ltd. (1983).

The subject is reviewed in sections, entitled: introduction (including - radiation damage production in typical reactor components); structure- and composition-sensitive properties (including - summary of failure mechanisms and design rules; dependence of microhardness on composition of a nickel-chromium stainless steel; composition dependence of irradiation-induced swelling of Fe-Cr-Ni ternary alloys; common fracture modes in highly irradiated structural alloys); mechanisms of irradiation-induced solute segregation; phase stability and irradiation-induced segregation; alloy design; summary.

33696 X-ray diffraction study of shape memory in uranium-niobium alloys. Carpenter, D.A.; Vandermeer, R.A. (Oak Ridge Y-12 Plant Union Carbide Corp., Nuclear Division Oak Ridge, TN 37830). pp 307-312 of Advances in x-ray analysis. Vol. 26. Hubbard, C.R.; Barrett, C.S.; Leyden, D.E.; Predecki, P.K. New York, NY; Plenum Publishing Corp. (1982). (CONF-820861—). Contract W-7405-ENG-26.

From 31. annual Denver X-ray conference; Denver, CO, USA (3 Aug 1982).

This chapter reports on an x-ray diffraction study of the reversible deformation modes associated with the shape memory

effect carried out on a series of uranium-niobium alloys near the monotectoid composition (6.2 wt. % Nb). Measures diffraction patterns as a function of strain, in situ, while the specimens were under stress as part of an attempt to explain the "easyflow", low-strain plateau in the stress-strain curve. Analyzes data obtained from a monoclinic alloy and a dual-phase monoclinic + tetragonal alloy. Finds that the principal reversible deformation modes in the single-phase monoclinic alloys and in the dual-phase monoclinic + tetragonal alloys correspond largely to those observed in other shape-memory alloys.

33697 **Digital faradaic impedance measurements (DPIM) on an array processor-enhanced system.** Smyrl, W.H. (Sandia National Lab., Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 342(1981). (CONF-811013—Vol.81-82-Absts). Contract AC04-76DP00789.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33698 **Electrochemistry and corrosion of Cu in aqueous HCl.** Smyrl, W.H. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 359(1981). (CONF-811013—Vol.81-82-Absts). Contract AC04-76DP00789.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 32695, 32700, 32701, 32729, 33192, 33493, 33589, 33745, 33829, 34919

33699 **(BMFT-FB-T—83-297) MoO_3, ex MoS_2 with further processing of the metal-bearing waste sulfuric acid generated in the process.** Bauer, G.; Eckert, J.; Retelsdorf, H.J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1983. 18p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751285.

After a literature study and preliminary tests, laboratory scale tests were made which yielded the following results: MoS_2-concentrates of all available grades can be completely converted to molybdenum oxide without previous treatment in an oxygen leaching process in an autoclave. The sulfuric acid produced in the process is recycled, SO_4 (in form of gypsum), Cu, and Re are periodically removed from the solution. The processing parameters determined in the laboratory experiments were tested at semi-commercial scale. While tests in a tube reactor had to be concluded without success, investigations in a four-compartment stirrable autoclave were successfull. With reaction temperatures of about 225°C and 3-5 bar O_2 partial pressure the oxidation is complete after about 8 h. The molybdenum oxide technical grade after drying and calcining contains max. 0.10% S. It can be processed to ferro-molybdenum without difficulties. By recycling of the sulfuric acid solution produced it is possible to recover in form of MoO_3 technical grade more than 98% of the molybdenum charged in MoS_2. The Re-recovery rate is considerably higher than that in the MoS_2 roasting process and can, in relation to the concentrates' contents, reach more than 90%. Even high-Cu containing concentrates can be processed without problems; Cu-sulfate is removed from the recycled solution by cooling crystallization. The sulfur in the MoS_2-concentrate is oxidised to sulfate and removed from the circulating solution in form of gypsum. The processing parameters determined are to be tested in a continuously working pilot plant in processing of all varieties of raw materials in long-term operations.

33700 **(BMFT-FB-T—83-322) Development of silicon nitride gas turbine components. Phase 2.** Gugel, E.; Kessel, H.; Leimer, G.; Lindner, H.; Novotny, A.; Petzenhauser, I.; Steinmann, D. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1983. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751420.

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The project, which was performed by Annawerk GmbH, aimed at the development of reaction-bonded silicon nitride (RBSN) and hot-pressed silicon nitride (HPSN) and at the new development of pressureless-sintered silicon nitride (SSN) with regard to materials technology and testing. The main tasks were materials development, component fabrication and testing, and test methods. In the field of RBSN powder technology, pre-sintering and mechanical properties could be improved. The effects of additives, e.g. Fe, and temperature-dependet deterioration of strength in the first phase of the project were clarified in theory and practice. In the case of HPSN with MgO and Y_2O_3 as additives, further improvements were made in mechanical strength at room and high temperature and in oxidation resistance. Complex-shaped prototype components were fabricated and tested. A free grain polishing post-treatment promised to be very sucessful. Further improvement of testing procedures included nondestructive testing of components by ultrasonics, resonance-frequency measurements and statistical methods of fracture mechanics for life predictions. With regard to SSN remarkable progress in materials development was achieved and applied also in components.

33701 **(CONF-840842—16) Specific heat-measurement of an $ErRh_4B_4$ single crystal.** Depuydt, J.M.; Dahlberg, E.D.; Hinks, D.G. (Minnesota Univ., Minneapolis (USA). Dept. of Physics and Astronomy; Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84011705.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

Measurements of the heat capacity of a single crystal of $ErRh_4B_4$ have been made in the temperature range of 0.4 K to 1.5 K. This temperature range includes the temperature for the superconducting to ferromagnetic transition. The measurements include data taken on both heating and cooling of the sample. The transition as measured when the heat capacity is hysteretic in temperature and has a sharp maximum in both the heating and cooling cycles which occurs at the same temperature as the occurrence and disappearance of the satellite lines observed in the neutron scattering.

33702 **(CONF-8405190—1) Chemical vapor deposition of erosion resistant TiB_2 coatings.** Caputo, A.J.; Lackey, W.J.; Wright, I.G. (Oak Ridge National Lab., TN (USA); Battelle Columbus Labs., OH (USA)). 1984. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012351.

From 9. chemical vapor deposition conference; Cincinnati, OH, USA (6 May 1984).

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TiB_2 coatings were chemically vapor deposited by hydrogen reduction of $TiCl_4$ and BCl_3. Process variables investigated were deposition temperatures from 750 to 1050°C and the $TiCl_4$ and BCl_3 flow rates. Various grades of commercially available cemented carbides and experimental nickel-bonded TiB_2 were used as substrates. Resistance of the coatings to erosion was evaluated using a hot, coal-oil slurry impingement test. The TiB_2 deposition rate was temperature dependent ranging from 0.1 to 2.9 μm/min between 750 and 950°C. The surface morphology of the coatings was nodular with the size of the nodules increasing with temperature. The coatings were dense and adherent. The grain size varied with deposition conditions. TEM showed the grain size to be very small (2 to 300 nm), increasing with distance from the substrate. Electron microscopy and x-ray diffraction indicated only the presence of single-phase TiB_2 and ion microprobe analysis revealed a constant Ti/B ratio across the coating thickness. Energy dispersive fluorescence analyses showed coatings deposited at 800°C contained more chlorine than coatings deposited at the higher temperatures. Coating microhardness and erosion resistance were temperature dependent. The hardness of coatings deposited at 800 and 900°C were 15 and 32 GPa, respectively. Coatings deposited at 850°C or below experienced extensive erosion (up to 30 μm deep craters during a 1 h test) while those deposited at 900°C and above showed very little or no erosion (0 to 2 μm).

33703 (DOE/ER—0113/3, pp 1-3) **Property studies of solid tritium breeding materials.** Johnson, C.E.; Fischer, A.K.; Shearer, J.A.; Tam, S.W.; Tetenbaum, M. (Argonne National Lab., IL). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

We have completed an experimental investigation of the solubility of H_2O in Li_2O. The data from this work have been analyzed and placed in a form suitable for thermodynamic calculations. These calculations permit detailed consideration of the thermodynamic (not kinetic) characteristics of tritium release from the Li_2O system as well as of the chemical and thermal stability. Included is a firmer understanding of the phase relationships and vaporization behavior. Ceramics other than Li_2O that are to be treated similarly are γ-$LiAlO_2$, Li_4SiO_4, Li_2ZrO_6, and Li_2BeO_2.

33704 (DOE/ER—0113/3, pp 17-22) **TRIO-01 experiment.** Clemmer, R.G.; Finn, P.A.; Billone, M.C.; Misra, B.; Greenwood, L.R.; Dyer, F.F.; Dudley, I.T.; Bate, L.C.; Clemmer, E.D.; Fisher, P.W. (Argonne National Lab., IL). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

The TRIO-01 experiment was designed to test in-situ tritium recovery and heat transfer performance of a candidate solid breeder, γ-$LiAlO_2$. The results showed that nearly all the tritium generated was recovered. Only <0.1 wppM tritium remained in the solid after irradiation testing. The heat transfer performance showed that temperature profiles can be effectively controlled.

33705 (DOE/ER—0113/3, pp 23-24) **Evaluation of electrical properties of SiC for ICRH window applications.** Fowler, J.D. Jr. (Los Alamos National Lab., NM). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

Silicon carbide has been proposed as an ICRH window material because of its inherent strength and compatibility with the fusion first-wall environment. Because of its low resistivity relative to other ceramics, its electrical characteristics may be of questionable suitability. The purpose of this preliminary study was to determine whether one common form of SiC is suitable for this application.

33706 (DOE/ER—0113/3, pp 25-29) **Structural performance of low-activation ceramics after high-dose neutron irradiation.** Clinard, F.W. Jr.; Hurley, G.F.; Hobbs, L.W.; Rohr, D.L.; Youngman, R.A. (Los Alamos National Lab., NM). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

Several forms of the ceramics $MgAl_2O_4$, Al_2O_3, Si_3N_4, and SiC/graphite laminate were irradiated to 2 x 10^{26}n/m^2(E > 0.1 MeV) at 680 and 815K. Dimensional changes ranged for near-zero for spinels to ~ 7 vol % shrinkage for graphite. Strength of spinels was increased, while that for Al_2O_3 and Si_3N_4 was not greatly changed. The SiC/graphite composite suffered almost-complete delamination.

33707 (INIS-BR—107, pp 77-78) **Electronic states of a hydrogen impurity in a f.c.c. host.** Souza, A.L.A. de; Teixeira, R.R.; Iglesias-Sicardi, J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33708 (INIS-mf—8921, pp 77) **NMR study of the ferromagnetic beta-uranium hydride.** Barash, Y.; Barak, J. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Mintz, M.H. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

Published in summary form only.

33709 (INIS-mf—8934, pp 48-49) **^{57}Fe- and ^{121}Sb-Moessbauer spectroscopy for studying the effects of diamagnetic substitutions in selected ferrites.** Dehe, G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jul 1983. NTIS (US Sales Only), PC A18/MF A01. Order Number TI84780273. (CONF-8309217—Absts.).

From 6. European conference on soft magnetic materials; Eger, Hungary (6 Sep 1983).

33710 **(LA-UR—84-1525) Anomalous surface impedance in reentrant ferromagnetic superconductors.** Huang, C.Y.; Kozlowski, G.; Mancini, F.; Maple, M.B.; Matsumoto, H.; Olson, C.E.; Umezawa, H.; Whitehead, J.P. (Los Alamos National Lab., NM (USA); Alberta Univ., Edmonton (Canada); Salerno Univ. (Italy). Ist. di Fisica; California Univ., San Diego, La Jolla (USA)). May 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012634.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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For $ErRh_4B_4$, owing to the critical spin fluctuations just above T/sub s/ (> T/sub c2/), the critical temperature at which surface ferromagnetism appears, the reciprocal penetration depth, λ^{-1}, decreases smoothly as T decreases toward T/sub s/. For $Er_{0.5}Ho_{0.5}Rh_4B_4$, the decrease in λ^{-1} for T > T/sub c2/ is very small, and λ^{-1} decreases abruptly at T/sub c2/.

33711 **(PB—84-178920) Investigation of methods for producing reactor-grade zirconium oxide from a zirconium-bearing chloride-sulfate strip liquor solution. Report of investigations/1984.** MacDonald, D.J.; Defilippi, C.E.; Henry, H.G. (Bureau of Mines, Reno, NV (USA). Reno Research Center). Feb 1984. 16p. (BM-RI—8850). NTIS, PC A02/MF A01.

The Bureau of Mines investigated two alternative methods for treating a zirconium-bearing chloride-sulfate strip liquor to obtain reactor-grade ZrO2. One method involves neutralization with NH3 and the other hydrothermal precipitation. The strip liquor was derived from zircon sand by a Bureau of Mines method for separating zirconium and hafnium via solvent extraction with a tertiary amine. Neutralization with NH3 to precipitate hydrous zirconium oxide required 0.9 to 1.1 g NH3 per gram of zirconium. The NH3 can be recovered for recycle. ZrO2 that met reactor-grade specifications was produced by precipitation with NH3. Hydrothermal precipitation of ZrO2 from strip liquor required that the solution be maintained at 260C and 680 psi for 10 min and in a noncorrodible pressure vessel. In bench-scale experiments both methods gave zirconium recoveries greater than 99 pct.

33712 **(UCRL—15603) Investigation of shock activated sintering and shock wave consolidation of selected powder materials. Final report.** Mote, J.D.; Fitzpatrick, J.J. (Denver Research Inst., CO (USA)). Feb 1984. Contract W-7405-ENG-48. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013074.

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Objective of the first part of the program was to investigate the shock activation of titanium carbide, titanium diboride, aluminum nitride and aluminum oxide powders using the cylindrical geometry. A series of shock activation experiments was conducted in which the starting temperature of the material was the major variable. The effect of temperature on the defect structure created when the sample was subsequently shocked was investigated. Em-

phasis was then shifted to the direct consolidation of the selected powders. Again the cylindrical configuration was chosen and the initial temperature was the major variable. In both cases, the shock wave was created by detonating a uniform layer of powdered explosive which surrounded the sample container. The explosive layer is simultaneously initiated around the periphery of the cylinder at one end. The circumferential shock front thus progressed axially along the sample container wall.

33713 Optical-phonon structure and precision neutron total cross section measurements of zirconium hydride. Malik, S.S. (Rhode Island Univ., Kingston (USA). Dept. of Physics); Rorer, D.C.; Brunhart, G. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Physics F: Metal Physics;* **14**: No. 1, 73-81(Jan 1984).

Precision total neutron cross section measurements of ZrHsub(1.58) were performed using a highly monochromatic neutron beam for neutron energies between 0.035 and 1.1 eV. The experimental values of the cross section in the region of the one-phonon optical peak (0.100 eV < Esub(n) < 0.250 eV) compare well with calculations if one assumes that the phonon spectrum, g(epsilon), is represented by three Gaussians centred at 0.132, 0.137 and 0.151 eV, with associated widths of 0.05, 0.02 and 0.01 eV, respectively. The phonon spectrum g(epsilon) departs from the calculations as exemplified by the central force (CF) model of ZrH_2. Such departures may arise due to non-central forces and tetragonality. The structure of g(epsilon) in some respects is similar to that observed in inelastic neutron scattering cross section measurements. The results from these two independent and different types of measurements provide sufficient basis for further attempts toward a more realistic theoretical model of ZrH_2.

33714 (LA-tr—84-21) Effect of pressure on the solubility of molecular water in a β-phase palladium-hydrogen system. Perminov, P.S.; Orlov, A.A.; Frumkin, A.N. Translated from *Doklady Akademii Nauk SSSR ;* **84**: No. 4, 749-752(1984). Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013368. DE84013368

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The experimental data presented demonstrate the presence of a logarithmic relationship in the palladium β-phase region up to concentrations of 0.92 g/atm H/g-atm Pd and a satisfactory agreement between the obtained results and electrochemical data. A logarithmic relationship very probably exists also for other solutions of gases in metals in regions of high lattice filling.

33715 Performance results on a C-SiC alloy coating chemically vapor-deposited onto graphite substrates. Trester, P.W.; Hopkins, G.R.; Kaae, J.L.; Whitley, J. (GA Technologies, Inc., San Diego, CA). *Thin Solid Films;* **108**: No. 4, 383-393(28 Oct 1983). (CONF-830443—).

From Metallurgical coatings conference; San Diego, CA, USA (18 Apr 1983).

A new coating material was successfully tested in both the limiter and the beam armor tile positions in Doublet III, an experimental tokamak fusion device. The coating material is an alloy of about 10 wt.%SiC in pyrolytic carbon deposited onto graphite substrate tiles of sizes up to 10 cm X 10 cm X 2.5 cm. Performance of the coating on graphite tiles under conditions of localized thermal shock was also investigated in laboratory simulation studies using electron beam energy depositions at power densities greater than levels normally experienced in tokamak service. The results of the test are presented along with observations made during surface examination and microstructural evaluation of the coating. The coating features and deposition model are also described. In a review of related studies of the C-SiC alloy coating, emphasis is placed on the two key advantages, low atomic number and low chemical sputtering, offered by this coating for use on graphite substrates to achieve improved plasma performance in both present and next-generation fusion devices.

33716 X-ray energy dispersive spectroscopy of intergranular phases in βll sialons. Dinger, T.R.; Thomas, G. (Dept. of Materials Science and Mineral Eng. and the Materials and Molecular Research Division Lawrence Berkeley Lab., Univ. of California Berkeley, CA 94720). pp 339-350 of Advances in materials characterization. Vol. 15. Rossington, D.R.; Condrate, R.A.; Snyder, R.L. New York, NY; Plenum Publishing Corp. (1983). (CONF-820891—). Contract AC03-76SF00098.

From 18. ceramic science conference on advances in materials characterization; Alfred, NY, USA (16 Aug 1982).

The purpose of this chapter is to determine whether segregation of impurities or A1 partitioning is occurring, and whether these mechanisms can then be interpreted as a cause for the retention of noncrystalline intergranular phases in low A1 solid solution alloys. Uses x-ray energy dispersive spectroscopy in conjunction with scanning transmission electron microscopy to qualitatively and semi-quantitatively characterize retained noncrystalline phases in several compositions of sialons. Uses diffuse dark field imaging in conventional transmission mode to identify noncrystalline phases prior to x-ray microanalysis. Finds that partitioning of A1 and impurity atoms does not occur for these compositions except in isolated cases. Suggests that Fe impurities are readily incorporated into the matrix phase.

33717 Characterization of imperfections in plasma-sprayed titania. Berndt, C.C.; Herman, H.; Jonca, A.; Korlipara, R.; MacCrone, R.K.; Templeton, T.; Zatorski, R.A. (Dept. of Materials Science & Eng. SUNY at Stony Brook, NY 11794). pp 465-472 of Advances in materials characterization. Vol. 15. Rossington, D.R.; Condrate, R.A.; Snyder, R.L. New York, NY; Plenum Publishing Corp. (1983). (CONF-820891—). Contract AC02-79ER10428.

From 18. ceramic science conference on advances in materials characterization; Alfred, NY, USA (16 Aug 1982).

This chapter presents a magnetic and morphological study of plasma-sprayed TiO_2 coatings by examining the EPR spectra at various temperatures, the dc magnetization, their microstructure, and their chemistry using electron microprobe analysis. Discusses plasma spraying, magnetic measurements, substrate-sprayed specimens, adhesion, and the defect state. Shows magnetic measurements to be a powerful method of obtaining new information about plasmasprayed oxides. Demonstrates that significant interaction in the form of substrate melting occurs on the impingement of the molten particles. Notes that although the temperature dependence suggests metallic inclusions, the deduced magnetization is not in agreement with the magnitude appropriate for iron. Finds that the predominant ionic defect detected was the Ti^{+3} ion, in concentrations very similar to titania, reduced under moderate conditions.

33718 Surface characteristics of yttria precursors in relation to their sintering behavior. Akinc, M.; Rasmussen, M.D. (Ames Lab., Iowa State Univ. Ames, IA). pp 159-170 of Advances in materials characterization. Vol. 15. Rossington, D.R.; Condrate, R.A.; Snyder, R.L. New York, NY; Plenum Publishing Corp. (1983). (CONF-820891—). Contract W-7405-ENG-82.

From 18. ceramic science conference on advances in materials characterization; Alfred, NY, USA (16 Aug 1982).

This chapter examines the effect of various drying techniques and the surface characteristics of the yttria precursors, and draws some correlations between precursor characteristics and the sinterability of the oxide powders. Discusses the precipitation of the precursors and the sintering experiments. Finds that the method of precursor drying has a major effect (probably more than any other step) on the sinterability and microstructure of the yttria ceramics. Assigns a tentative value for the isoelectric point for freshly prepared hydroxide and offers an explanation for the effect of the drying technique on the sinterability of yttria.

3603 Composite Materials

33719 **(DOE/ER/04027—1) Probabilistic models of the stress-rupture of composite materials: summary. Final report, June 15, 1976-June 14, 1984.** Phoenix, S.L. (Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering). Jun 1984. Contract AC02-76ER04027. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013477.

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Time-dependent failure in the long term (stress- or creep-rupture) results from flaw growth in the fibers, and/or viscoelastic creep in the matrix. Progress has been made in modeling the failure process described. A matrix-impregnated bundle is viewed as a chain of short microbundles with localized load-sharing among fiber elements in a cross-section. The model for fiber failure has its roots in the thermal kinetics of molecular slippage and scission. Various localized load-sharing rules for fiber elements in a microbundle have been assumed. Early research focused on static small bundles. Subsequently, three powerful asymptotic methods were developed. Progress was made in modeling statistical failure in 3-D composites with fibers arranged in a hexagonal array, developing asymptotic analyses for the time-dependent problem where the load-sharing among fibers is elastic but the fiber strength decays stochastically in time and experimental verification of the model. Progress was also made in developing a powerful recursion analysis for k-failure in the time-dependent problem. In order to use the results in creep-rupture settings, we first modified the fiber model to allow for random initial fiber breaks and finite molecular length in our crystal model for fiber failure. A Markov analysis was developed for small bundles. Key limit theorems for k-failure were developed thus verifying the existence of the characteristic distribution for composite lifetime. Randomly spaced initial fiber breaks weaken the composite and increase its variability in lifetime. We also demonstrated how a Weibull shape parameter value of less than one can occur for fiber lifetime. Effect of gauge length on the strength distribution of filaments was examined, using Weibull statistics. Values for the shape parameter calculated at a fixed gauge length are lower than those obtained by a procedure based on varying the gauge length.

33720 (INIS-mf—8921, pp 68) **Self-duality and the critical properties of the low field Hall effect in two-dimensional and three-dimensional metal-insulator composites.** Kantor, Y.; Bergman, D.J. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

33721 **(PB—84-178201) Fibre reinforced plastics at cryogenic temperatures: a listing containing 315 references.** Summerscales, J.; Short, D. (Plymouth Composite Materials Research Group (England)). Mar 1984. 23p. NTIS, PC E03/MF E01.

See also PB84-178227.

This listing of current world literature on cryogenic properties of fiber reinforced composite materials is arranged by alphabetical sequence of the authors' surnames, with chronological listing within that group. Anonymous papers are included at the end of the list. The coverage includes journal articles, textbook chapters, establishment reports, proceedings, patents and dissertations. The bibliographic detail has been compressed in order to minimize the storage space used on the Polytechnic PRIME 9950/10Mb computer where the database was stored on a magnetic disc.

33722 **(UCID—19789) Matrix-dominated time-dependent deformation and damage of graphite/epoxy composite experimental data under creep and recovery.** Wu, E.M.; Sanchez, R.J.; Nguyen, N.Q. (Lawrence Livermore National Lab., CA (USA)). Jun 1983. Contract W-7405-ENG-48. 394p. (AFWAL-TR—83-3066). NTIS, PC A17/MF A01; 1; GPO Dep. Order Number DE84013069.

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The objective of this report is to disseminate experimental data of matrix-dominated time-dependent deformation and time-dependent damage in graphite-epoxy composite. The composite specimens were +- 45° T300/5208 laminates tested in tension under creep and creep-recovery with complete instrumentation for stress, strain, and time recordings. Experimental data was recorded and archived in digital form. Polynomial series are fitted to the experimental data for compilation, dissemination and future retrieval.

33723 **(UCRL—90604) Cure reactions, network structure and mechanical response of diaminodiphenyl sulfone cured tetraglycidyl 4,4'diaminodiphenyl methane epoxies.** Mones, E.T.; Morgan, R.J. (Lawrence Livermore National Lab., CA (USA)). 11 May 1984. Contract W-7405-ENG-48. 7p. (CONF-840805—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012607.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

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Diaminodiphenyl sulfone (DDS) cured tetraglycidyl 4,4'diaminodiphenyl methane (TGDDM) epoxies are the most common composite matrices utilized in high performance fibrous composites. This paper reports latest Fourier transform infrared spectroscopy (FTIR) studies of the cure reactions and network structure of TGDDM-DDS epoxies.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 32717, 33184, 33325

33724 **(AD-A—140020/9) Surface and bulk phase separations in block copolymers and their blends. Interim report 30 Sep 82-30 Dec 83.** Patel, N.M.; Dwight, D.W. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Mar 1984. 137p. (VPI-E—84-7). NTIS, PC A07/MF A01.

Surface and bulk properties have been studied in terms of composition and morphology of siloxane containing block copolymers and their blends with homopolymers. X-ray Photoelectron Spectroscopy (XPS) has been used to obtain the compositional information from the top 60 angstroms or so at the surface. Transmission Electron Microscopy (TEM) was utilized to probe the bulk morphology. An attempt is made to compare the bulk and the surface and find possible mechanisms governing them. It is found that solvent-cast neat block copolymers have a uniform layer at the surface that is rich in siloxane whereas their bulk has a microphase-separated domain structure. In case of blends, siloxane enrichment is quite pronounced even at bulk concentrations as low as 0.05% w/w siloxane. Amount of surface siloxane as a function of bulk content is studied with the help of XPS. At the same time, the bulk morphology of these blends is studied by TEM. The changes occuring in the surface and the bulk are found to have similar patterns.

33725 (DOE/ER—0113/3, pp 40-47) **Cryogenic neutron irradiation effects in organic insulators for superconducting coils.** Fowler, J.D. Jr.; Clinard, F.W. Jr. (Los Alamos National Lab., NM). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

Samples of three epoxy-based and three polyimide-based materials were irradiated up to 4.1 x 10^{21} n/m^2 at 4 K. Electrical properties subsequently measured at 295 and 80 K showed no major changes. Fraction of original strength retained at 75 K for the three materials tested to date were: 33% for G-10 CR, 88% for G-11 CR, and ~ 100% for NP-530. Strengths at 300 K were less affected.

33726 (DOE/ER—0113/3, pp 48-51) **Materials and test methods.** Kasen, M.B. (National Bureau of Standards, Boulder, CO). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

The industrial specification for production of the G-10CR grade of cryogenic high-pressure laminate has been revised and accepted by US manufacturers. The objective was to make the specification as generic as possible without adversely affecting perform-

ance and to add a material performance criteria to the specification. G-10CR and G-11CR products have been produced by five US industrial laminating forms. No significant differences in cryogenic mechanical properties were found among G-10CR material produced by these manufacturers. This indicates that the specifications are fulfilling their intended purpose. An efficient system for producing research materials for systematic screening of the parameters influencing cryogenic radiation resistance was devised. Laboratories in Japan and England have agreed to actively cooperate with NBS in further development of this system.

33727 **(DOE/ER/10912—3) Rubber elasticity. Progress report, April 1, 1983-March 15, 1984.** Eichinger, B.E. (Washington Univ., Seattle (USA). Dept. of Chemistry). 1984. Contract AT06-81ER10912. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013748.

Portions are illegible in microfiche products.

The progress report submitted one year ago reviewed work on random networks, polymeric chelates, and differential sorption. Within the past year our group has continued its research in these areas and has added two major new thrusts into: (1) the study of the critical phenomenon of gelation; and (2) the theory of the shape distribution of macromolecules.

33728 (INIS-BR—107, pp 70-71) **Vibrational dynamics of a simple polymer.** Scherer, C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Naghizadeh, J. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachrichtung Theoretische Physik). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33729 (INIS-BR—107, pp 71-72) **Vibrational dynamics of a simple polymer. Part 2.** Costa, J.A.T.B. da; Scherer, C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33730 **(PB—84-175538) Mechanical behavior of ultra high molecular weight polyethylene. Annual report No. 4, 1 Oct 82-30 Sep 83.** Crissman, J.M. (National Bureau of Standards, Washington, DC (USA)). Jan 1984. 44p. (NBSIR—84-2808(FDA)). NTIS, PC A03/MF A01.

Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

This report describes work done during FY 1983 under task 80-01, NBS-FDA/BMD (Bureau of Medical Devices) Interagency Agreement. The report covers the fourth year of a four year project concerned with the study of the morphology and mechanical properties of ultra high molecular weight polyethylene (UHMWPE). The work done during FY 1983 dealt principally with the following aspects of the mechanical behavior of UHMWPE, (1) the temperature dependence of the creep and recovery behavior of uniaxial extension and compression at small deformations, (2) longer term (>1 day) creep and recovery behavior of uniaxial extension and compression at small deformations, (3) the effect of gamma-irradiation on the creep and recovery behavior, and (4) the effect of gamma-irradiation on the environmental stress-crack resistance of UHMWPE.

33731 **(SAND—84-0891C) Poly(trimethylsilylacetylene): a tractable, synthetically manipulable polyacetylene derivative.** Zeigler, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840805—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010299.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

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A soluble, synthetically manipulable polyacetylene derivative, poly(trimethylsilylacetylene) (PTMSA) (C(Si)CH$_3$)$_3$=CH)/sub n/ can be prepared in good yield with molecular weights in excess of 10^5 by polymerization with a new class of catalysts formed by mixing WCl_6 with organolithium or organomagnesium reagents. The polymer possesses moderate O_2 stability and can be reversibly doped with I_2 vapor to a conductivity of 10^{-4} S/cm. The unique ability of silyl substituents to stabilize charged intermediates and undergo ipso substitution allows partial replacement of the silyl groups in PTMSA by both electrophilic and nucleophilic reagents. Thus, desilation of PTMSA with fluoride provides a soluble TMSA-acetylene copolymer. Additional synthetic transformations of PTMSA will be reported along with conductivity data on some of the new materials prepared from PTMSA.

33732 **(UCRL—90642) Dynamic overstresses in fibrous polymeric materials.** Cook, R.C.; Mercer, M.B. (Lawrence Livermore National Lab., CA (USA)). 11 May 1984. Contract W-7405-ENG-48. 7p. (CONF-840805—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012605.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

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The work most closely related to the study presented here is that of Hedgepeth, in which he analyzes the stress redistribution due to filament failure in a sheet of parallel filaments which carry normal loads and are embedded in a matrix which carries only shear. In our work we have studied the similar discrete problem where the filaments have been replaced by chains of harmonically coupled masses and the shear acts only between mass points on neighboring chains. Our motivation in studying a discrete system is to reduce the lower end of the scale of applicability of the model to the molecular level. Our molecular dynamics techniques also allow us to easily investigate the three-dimensional problem not treated by Hedgepeth. The model is described and a comparison of our results and those of Hedgepeth made.

33733 **(UCRL—90657) Viscoelastic and aging characteristics of polymers.** Feng, W.W. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 13p. (CONF-8406138—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012689.

From 8. inter-American conference on materials technology; San Juan, Puerto Rico (25 Jun 1984).

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This paper concerns the time dependent mechanical properties for incompressible polymer-like materials subjected to finite deformations. There are two parts: the viscoelastic effects and the aging characteristics. A method for determining these mechanical properties is presented in detail.

33734 **Low-temperature specific heat of PTFE (Teflon) at pressures to 5.2 kbar.** Boyer, J.D.; Lasjaunias, J.C.; Fisher, R.A.; Phillips, N.E. (Lawrence Berkeley Lab., CA). *Journal of Non-Crystalline Solids;* **55**: 413-432(1983). Contract AC03-76SF00098.

The specific heat of PTFE (Teflon) has been measured between 0.3 and 20 K at zero pressure, and between 1 and 20 K at five other pressures ranging up to 5.2 kbar. The specific heat anomalies typical of amorphous materials were observed. The linear term is smaller than for other organic polymers and is closer in magnitude to those of high purity glassy insulators. At zero pressure the T^3 term in the specific heat exceeds that calculated from the sound velocities by 24%. The evolution with pressure of the T^3 term and of the maximum in C/T^3 are very similar, suggesting a close relation between the vibrational modes that contribute to these features in the specific heat. This result and the relatively simple structure of Teflon rule out independent localized oscillators as the source of the maximum in C/T^3.

33735 **(ORNL-tr—5120) Activity of catalysts in polyurethane synthesis.** Olczyk, W. Translated from *Organika ;* **26**: No. 8, 9(1979). Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010369. DE84010369

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The paper deals with the activity of catalysts used in polyurethane technology. The methods employed to determine this activity are discussed and the mutual noncomparability of these methods is indicated. A more universal method of assessing this activity,

based on the viscosity increase in test reactions, is proposed. The influence of some factors that affect catalyst activity is presented with examples.

3606 Other Materials

REFER ALSO TO CITATION(S) 32715, 32716, 32717, 32732, 32732, 32850, 32862, 32867, 32872, 32873, 32874, 33151, 33624, 34763

33736 **(AD-A—137231/7) Particle scattering studies on foreign ions in superionic conductors. Technical report.** Roth, W.L.; Benenson, R.E.; Ji, C.; Wielunski, L.; Dunn, B. (State Univ. of New York, Albany (USA). Dept. of Physics). 21 Dec 1983. 26p. (TR—1). NTIS, PC A03/MF A01.

The effects of foreign ions on the structures and properties of superionic conductors are being investigated. This paper reports Rutherford backscattering, nuclear reaction analysis, and channeling studies on NaBeta-alumina crystals doped with Mn by ion implantation and with Li and Mg from melts. Implantation disorders the NaBeta-alumina surface. On heating, the surface crystallizes, and Mn diffuses into Al sites. The melt-doped compositions are accounted for by Mg substitution in the spinel layer and by Li in the conduction plane. Particle scattering has been used to profile sodium and impurities in NaBeta-alumina ceramics and F disorder in Beta-PbF2.

33737 **(AD-A—139974/0) Corrosion control for reinforced concrete.** Torigoe, R.M. (Florida Univ., Gainesville (USA). Dept. of Civil Engineering). 1983. 101p. NTIS, PC A06/MF A01.

The National Bureau of Standards has recorded that in 1975 the national cost of corrosion was estimated at $70 billion. Approximately 40 percent of that total was attributed to the corrosion of steel reinforcements in concrete. Though concrete is generally perceived as a permanent construction material, cracking and spalling can occur when corrosion of steel reinforcements progresses to an advanced stage. This problem frequently occurs in reinforced concrete highway bridge decks, wharves, piers, and other structures in marine and snowbelt environments. Since concrete has a very low tensile strength, steel reinforcements are added to carry the tensile load of the composite member. Corrosion reduces the effective diameter of the reinforcements and, therefore, decreases the load carrying capability of the member. Though the corrosion process may occur in various forms and may be caused by different sources, the ultimate result is still the failure of the reinforced concrete.

33738 **(DOE/ER/10416—5) Nuclear magnetic resonance studies of ion motion in solid electrolytes. Annual report, April 1, 1983-March 31, 1984.** Bjorkstam, J.L. (Washington Univ., Seattle (USA). Dept. of Electrical Engineering). Dec 1983. Contract AT06-79ER10416. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013846.

Progress is reported on the following studies. (1) The microscopic nature of low lying excitations in disordered materials (primarily beta-aluminas and vitreous electrolytes). The focus of this work was to be a comparison of analytical models for phonon-disorder mode interactions with available low temperature NMR relaxation data in the beta-alumina family and borate glasses. (2) Contributions to the phenomenology of the glass transition; our intention in this study was to consider the relationship between thermal stability and conductivity in glass systems through a comparison of NMR data, collected near the glass transition in several borate glasses, with free-volume and liquid-phonon models. Another aspect of the study was an investigation of the relationship between ion diffusion and structural stability. Specific materials investigations have, thus far in the contract year, focused upon borophosphate glasses, and single crystal, powder and dispersed phase samples of lithium iodide monohydrate. The effort has been directed primarily toward phenomenology of the glass transition. (WHK)

33739 **(DOE/ER/10908—3) Studies of magnetism and exchange scattering in solids using synchrotron radiation and spin polarized photoemission. Final technical report, June 1, 1981-May 31, 1984.** Rothberg, G.M. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Materials and Metallurgical Engineering). Jan 1984. Contract AC02-81ER10908. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013691.

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Progress has been made toward developing Spin Polarized EXAFS (SPEXAFS) as a technique for studying magnetism in solids. The first observations have been made of EXAFS by means of photoemission with sufficient data to permit a traditional Fourier-transform analysis of atomic structure. Some of the advantages of photoelectron detection of EXAFS are: (1) vuv light may be used thereby extending greatly the useable range of photon energies; (2) the number of elements that may be studied for surface EXAFS is increased; (3) the possibility exists for measurements that cannot be done in other ways. In addition to its intrinsic interest, this result is crucial to the study of the spin dependence of EXAFS. These measurements were carried out on the vuv storage ring at the National Synchrotron Light Source. Data obtained on the spin dependence of EXAFS in MnF_2 at room temperature tentatively show dependence of the Mn absorber atom phase shift on the exchange interaction within the absorber atom. This effect has not been discussed theoretically. Preliminary observations have been made of the Fano resonance in Mn 3d photoemission at the 3p to 3d threshold.

33740 **(DOE/ER/45038—1) X-ray spectroscopy of solids under pressure. Annual progress report, August 1983-July 1984.** Ingalls, R.L. (Washington Univ., Seattle (USA). Dept. of Physics). 23 Mar 1984. Contract AT06-83ER45038. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013790.

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X-ray absorption studies of several materials as a function of pressure have been performed. Of particular interest has been the EXAFS (extended x-ray absorption fine structure) and XANES (x-ray absorption near edge structure). Materials studied include the alkali halides, NaBr and RbCl, zinc blend semiconductors ZnSe and CuBr and mixed-valence materials SmS and SmSe. In the former, the volume dependence of bond lengths and their mean square fluctuations were determined from the EXAFS. In the latter materials the XANES exhibited the pressure induced change from the Sm^{2+} configuration to Sm^{3+}.

33741 (INIS-BR—107, pp 72) **Melting mechanisms in paraffins and liquid crystals.** Holz, A. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachrichtung Theoretische Physik); Scherer, C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33742 (INIS-BR—107, pp 76) **Two-band model for intermediate valence compounds.** Iglesias-Sicardi, J.R.; Aveline, I.M.S. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33743 (INIS-BR—107, pp 76) **Electrical resistivity of Sm Monochalcogenides.** Aveline, I.M.S.; Iglesias-Sicardi, J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33744 (INIS-BR—107, pp 78) **Some properties of intermediate valence compounds.** Rosa Simoes, A.S. da; Iglesias-Sicardi, J.R.; Anda, E.V. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33745 (INIS-mf—8903, pp 133-137) **Ion bombardment of some glass and glass-ceramic materials.** Livne, Z. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev); Ardell, A.J. (California Univ., Los Angeles (USA). Dept. of Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33746 (INIS-mf—8903, pp 141-146) **Alpha-recoil effects on dissolution of monazite.** Eyal, Y. (Technion-Israel Inst. of Tech., Haifa. Dept. of Nuclear Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33747 (INIS-mf—8903, pp 147-151) **Leaching behaviour of heat-treated monazite.** Eyal, Y. (Technion-Israel Inst. of Tech., Haifa. Dept. of Nuclear Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33748 (INIS-mf—8934, pp 100-101) **Magnetic behaviour of Fe-Si-B metallic glasses studied by neutron scattering.** Minor, W.; Kepa, H.; Giebultowicz, T. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej); Buras, B.; Lebech, B.; Clausen, K. (Risoe National Lab., Roskilde (Denmark)); Dmowski, W. (Politechnika Warszawska (Poland)). Jul 1983. NTIS (US Sales Only), PC A18/MF A01. Order Number TI84780273. (CONF-8309217—Absts.).

From 6. European conference on soft magnetic materials; Eger, Hungary (6 Sep 1983).

33749 (INIS-mf—8946) **Raman scattering in piezoelectric crystals with particular respect to orthorhombic $LiGaO_2$.** Knoll, P. (Vienna Univ. (Austria)). 1982. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780389.

As earlier works on simple polar crystals have shown, the Raman intensities of polar modes are to some extent determined by nonlinear optical properties; however, only very few investigations have been performed on more complicated crystals. In the theoretical part of this thesis the most important phenomens of Raman scattering in piezoelectric crystals, such as Polariton- and direction dispersion, and their relations to nonlinear optics are derived in a uniform way. These considerations lead to an equivalence between Raman scattering and anharmonic mixing of optical frequencies in the infrared region. Also a method was developed to determine the signs of the Raman tensor and nonlinear optical properties, such as electrooptic and SHG-coefficients from a quantitative Raman analysis alone. In the experimental part of this work a complete quantitative Raman analysis is given for the orthorhombic crystal $LiGaO_2$, which has 16 atoms per unit cell. One main aspect of the experiments was to find practical arrangements, which allow to perform the measurements, especially the direction dispersion, with only one sample with dimensions of few millimeters. The considerations of the theoretical part of this thesis were applied to the Raman- and nonlinear optical data of $LiGaO_2$ as well as to the published data of $LiNbO_3$. In both materials a good agreement between theory and experiment is found within the accuracy of the measurements. (Author).

33750 (INIS-mf—8952) **Study of the ^{23}Na EFG (Electrostatic Field Gradient) tensor on single crystals of $Na_2S.9H_2O$ by wideline NMR.** Miksche, G. (Technische Univ., Vienna (Austria)). 1982. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780337.

The quadrupole coupling constant 'e²qQ/n' of ^{23}Na has been determined by measuring single crystals of $Na_2S.9H_2O$ at room temperature. A value of 687.5 +- 1.2 kHz was found. The asymmetry parameter eta = (qsub(x'x') - qsub(y'y')) / qsub(z'z') of the efg-tensor is zero, there is axial symmetry. The principle axis of the efg-tensor runs parallel to the main crystallographic axis c, the value of the main component of the efg-tensor in c-direction is 171.875 +- 0.6 kHz. The longitudinal relaxation time T_1 has been evaluated as 1.8 s. On this account, the mean distance between two Na-atoms has been determined by measuring the splitting of the central line due to dipole-dipole interaction. The Na-Na distance was found with 0.36 +- 0.007 nm. This value is in good agreement with results from neutron diffraction studies. It was not possible to determine direction and length of hydrogen bonds by NMR-results. A method of growing single crystals of $Na_2S.9H_2O$ of demanded size and purity has been described. Constructional details and technical data of a self-made wideline-NMR-spectrometer are added in an appendix. (Author).

33751 (INIS-SU—222, pp 61-64) **Study of thermoradiation effects in alkali-borate, neodymium-phosphate and silicate glasses.** Petrovskij, G.T.; Vakhidov, Sh.A.; Ikramov, G.I.; Isaev, I.Kh.; Babaev, A.Kh.; Salakhitdinov, A.N. (GPI, Samarkand (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

A new mode of synthesis and treatment of glasses gamma-irradiated with ^{60}Co (dose 1000...4200 R/s) is considened. Radiation-optical characteristics of alkali-borate glasses of compounds $XR_2O(1-X)B_2O_3$ (X=0.8, 12, 18, 22, 28, 30, 35 mol. %, R=Na, K) with the additions of transition elements of Cu, Ni, Fe are studied. The relative variations of absorption spectra (lambda=260...1200 nm) photoluminescence and EPR (lambda=3.2s) are defined. The obtained data show the possibility of improvement of radiation and chemical resistance of optical materials.

33752 (INIS-SU—222, pp 68-69) **Radiation-induced diffusion of gold on silicon surface.** Gerasimov, A.B.; Kuteliya, Eh.R.; Melkadze, T.Eh.; Tsertsvadze, A.A. 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

The radiation-induced surface diffusion (RISD) of gold on silicon is studied. Silicon monocrystal of n-type with a specific resistance of rho approximately 0.02 w and dislocation density appr. 10^7 m^{-2} was chosen for the study. T e diffusion was carried out on three surface planes (100), (110), (111). The diffusion was studied in three regimes: a) at approximately 900 K, b) at approximately 330 K plus irradiation, c) at approximately 900 K. The diffusion rate was evaluated by a shift of gold film boundary under fixed experimental conditions. A conclusion was drawn from the results obtained, that a decisive role in radiation-induced sUrface diffusion played chemical bonds of a diffUsant with adjacent atoms of silicon crystal.

33753 (INIS-SU—222, pp 74-76) **Isothermal annealing of tritium from the irradiated LiF crystals with different faulty structures.** Timofeeva, Eh.E.; Ulanovskij, F.N. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

Tritium release at isothermal annealing (773 K) out of reactor irradiated monocrystal of lithium fluoride was studied. Irradiation was carried out both at 123 K and at 293 K. The dependence of effective tritium diffusion coefficient on concentration F-centers and dislocations implanted in crystal was received. As a result of thermal annealing of crystals with different F-centers and disloca-

tion concentration the time dependences of the tritium activity was obtained. To explain the obtained data a model of tritium interaction with crystal lattice defects is offered.

33754 (INIS-SU—222, pp 77-78) **Radiation transformation in aluminium yttrium garnet crystals irradiated in nuclear reactor.** Grigoryan, A.Kh.; Emel'yanov, K.A.; Nadirashvili, L.Sh.; Sarkisov, V.Kh. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki); Tsetskhladze, T.V. 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

The results of study of generation characteristics of $Y_3Al_5O_{12}:Nd^{3+}$ crystals irradiated in nuclear reactor were obtained by methods of optical absorption and microcalorimetry. The self-absorption band edge displacement of the crystals to the lons-wave side after (n, γ) irradiation is shown, This displacement occurs due to the radiation-induced defects in the solid matrix. The presence of short-lived defects in the irradiated crystals annealed up to 300 K by microcalorimetry methods is shown. Three ranges of heat evolution in the interval of 77-300 K for the samples irradiated with the fluence of 10^{18} n/cm^{-2} at 77 K are shown. An increase of radiation stability of $Y_3Al_5O_{12}$:Nd:Cr in comparison with $Y_3Al_5O_{12}:Nd^{3+}$ crystals under the same irradiation conditions is found. An improvement of generation characteristics of crystals under n, γ-irradiation with posterior annealing is observed. Hence, the possibility of the irradiation and then annealed $Y_3Al_5O_{12}:Nd^{3+}$ crystals application in laser installation is shown.

33755 (INIS-SU—222, pp 81-82) **Peculiarities of radiation-induced diffusion of alkali ions in quartz doped with germanium and aluminium.** Samojlovich, M.I.; Novozhilov, A.I. 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

33756 (LA-UR—83-2489) **Mechanisms of electrical conductivity in olivine.** Schock, R.N.; Duba, A.G.; Shankland, T.J. (Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-36. 13p. (CONF-840820—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE83017313.

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Data on the electrical conductivity and the thermoelectric effect in single crystals indicate that the charge conduction mechanism in pure magnesium forsterite is electrons. The concentration of electrons can be varied by controlling the number of oxygen vacancies through manipulation of the oxygen pressure. For iron bearing olivine, the conduction mechanism is by electron holes localized on an iron ion. Since iron strongly affects the creep process as well, oxidation of iron is probably accompanied by the production of magnesium vacancies. 15 references.

33757 (LA-UR—84-1017) **Magnetic susceptibility, electrical resistivity, and specific heat of single crystal $LaFe_4P_{12}$.** Meisner, G.P.; Stewart, G.R.; Torikachvili, M.S.; Maple, M.B. (Los Alamos National Lab., NM (USA); California Univ., San Diego, La Jolla (USA). Inst. of Pure and Applied Physical Sciences). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—7). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009979.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

The temperature dependence of the magnetic susceptibility and electrical resistivity, and the low temperature specific heat have been measured on single crystals of $LaFe_4P_{12}$. The data confirm both the occurrence of bulk superconductivity at 4.1°K and the absence of any magnetic ordering. $LaFe_4P_{12}$ is a relatively weakly coupled superconductor ($\lambda = 0.45$) and has a density of states at the Fermi energy of 0.98 states/eV-atom. The electrical resistivity exhibits metallic behavior and has a residual resistance ratio of ~ 90. The magnetic susceptibility is very weakly temperature dependent, saturating below 50°K at a value of 8.0×10^{-4} cm^3/mole.

33758 (LA-UR—84-1202) **Electrical resistivity of rare earth iron phosphides.** Torikachvili, M.S.; Maple, M.B.; Meisner, G.P. (California Univ., San Diego, La Jolla (USA). Inst. of Pure and Applied Physical Sciences; Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—14). NTIS, PC A02; 3; GPO Dep. Order Number DE84011413.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The electrical resistivity rho of the rare earth iron phosphides $REFe_4P_{12}$ (RE = La, Ce and Pr) has been determined as a function of temperature T. Although isostructural, the behavior of rho (T) is remarkably distinct for these three compounds. While $LaFe_4P_{12}$ is superconducting, $CeFe_4P_{12}$ exhibits a semiconductor-like behavior, and $PrFe_4P_{12}$ exhibits a feature at low temperatures that could be related to a combined structural and magnetic transition.

33759 (LBL—17825) **Study of hot phonons and hot carriers in GaAs under picosecond optical pulse excitation.** Collins, C.L. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 144p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84013243.

Thesis.

The ability of light scattering techniques to determine simultaneously many of the important properties of photoexcited electron-hole plasmas in GaAs was demonstrated. Scattering due to plasmons or coupled LO-plasmon modes can be used to determine the plasma density provided the spatial profile of the density is known. The distribution function and the drift velocity of the plasma in the direction of the laser beam can be determined from the SPE spectra. The fact that the plasma density can be determined independently of the distribution function enabled me to show that the electron distribution function in high density EHP in GaAs is nonthermal equilibrium within ~ 20 psec of excitation. This conclusion is consistent with previous experiments on photoexcited EHP in GaAs using picosecond lasers, although the form of the nonequilibrium distribution was not determined in the earlier measurements. At the moment there is very little information on the properties of transient high density EHP in semiconductors so it is too early to derive theoretical justifications for the power law distribution functions I deduced. However, one may speculate that this may have something to do with the slowing of hot carrier relaxation by emission of LO phonons due to screening of the Froehlich interaction. Also the rapid expansion of the EHP may have important consequence on the thermalization of the EHP.

33760 (N—8418401) **Shock temperatures in anorthite glass.** Boslough, M.B.; Ahrens, T.J.; Mitchell, A.C. (California Inst. of Tech., Pasadena (USA)). 1983. 33p. (NASA-CR—173364). NTIS, PC A03/MF A01.

Temperatures of CaAl2Si2O8 (anorthite glass) shocked to pressures between 48 and 117 GPa were measured in the range from 2500 to 5600 K, using optical pyrometry techniques. The pressure dependence of the shock temperatures deviates significantly from predictions based on a single high pressure phase. At least three phase transitions, at pressures of about 55, 85, and 100 GPa and with transition energies of about 0.5 MJ/kg each (approximately 1.5 MJ/kg total) are required to explain the shock temperature data. The phase transition at 100 GPa can possibly be identified with the stishovite melting transition. Theoretical models of the time dependence of the thermal radiation from the shocked anorthite based on the geometry of the experiment and the absorptive properties of the shocked material yields good agreement with observations, indicating that it is not necessary to invoke intrinsic time dependences to explain the data in many cases.

33761 (NP—4770328) **Distribution of humidity in porous materials as a consequence of non-steady water-vapour diffusion.** Husseini, F. (Dortmund Univ. (Germany, F.R.)). 21 Jun 1982. 151p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770328.

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In order to prevent damage of buildings and constructions, methods were developed to calculate diffusion and dew water formation in components. The most widely known methods however, adopt a steady-state view of the problem and do not take typical seasonal or temporal periods of the outside climate into account. This thesis contains a simple calculation method which considers these variations i.e. it is a calculation method for non-steady water vapour diffusion processes.

33762 **(PB—84-179498) Beneficial use of sludge in building components.** Alleman, J.E. (Purdue Univ., Lafayette, IN (USA). School of Civil Engineering). Dec 1983. 112p. NTIS, PC A06/MF A01.

Results are presented of a study in which sludge was introduced in the manufacture of brick. More than 300 bench-scale, sludge-amended bricks were produced with initial volumetric sludge additions of from 16% to 50%. These specimens looked, felt, and smelled like standard bricks, and those with sludge additions of 30% or less were found capable of meeting the appropriate technical standards. Three full-scale runs have been completed by a commercial manufacturer, and almost one million bricks have been produced. These bricks were found comparable to normal, unadulterated bricks; in fact, the incorporation of sludge was believed to be beneficial due to related improvements in the brick's water absorption properties. The name 'biobrick' is used to refer to the new product.

33763 **(UCRL—90866) Review of ultraviolet damage threshold measurements at Lawrence Livermore National Laboratory.** Lowdermilk, W.H.; Milam, D. (Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-48. 22p. (CONF-8404124—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012956.

From SPIE technical symposium; Arlington, VA, USA (29 Apr 1984).

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The results of damage threshold measurements made at LLNL using ultraviolet wavelength laser pulses are reviewed. Measurements were made with pulses from a krypton fluoride laser with wavelength of 248 nm and pulse duration of 20 ns and with Nd-glass laser pulses converted to the third harmonic wavelength of 355 nm with duration of 0.6 ns. Measurements are presented for transparent window materials, crystals and harmonic generation, single layer dielectric films of oxide and fluoride materials and multilayer high reflectivity and antireflective coatings.

33764 **Heatpulse annealing of ion-implanted silicon: structural characterization by transmission electron microscopy.** Sadana, D.K. (Lawrence Berkeley Lab., CA (USA)); Shatas, S.C.; Gat, A. (AG Associates, Palo Alto, CA (USA)). *Institute of Physics, Conference Series;* 143-148(1983). (CONF-8303121—). Contract AC03-76SF00098.

From Microscopy of semiconducting materials meeting; Oxford, UK (21 Mar 1983).

A detailed structural investigation of Heatpulse rapid thermal annealed ion-implanted Si was carried out using TEM. Defect-free material was obtained after an 1100 deg C/10 sec. anneal for 80 keV 2 x 10^{15} ^{75}As implanted Si, while dislocation loops were still present after lower temperature anneals. When compared with arsenic, 35 keV ^{11}B implanted Si in the dose range 5 x 10^{14} exhibited markedly different behavior under the same annealing conditions, in that residual defects in the form of line dislocations, loops, and rods were observed. Comparison with 1000 deg C/30 min. furnace annealed samples showed differences in defect structures and impurity redistribution behavior as revealed by SIMS measurements. A model explaining the annealing behavior of implanted layers in silicon under rapid annealing conditions is proposed.

33765 **A technique for measuring the apparent thermal conductivity of flat insulations.** Moore, J.P.; Jury, S.H.; McElroy, D.L. (Metals & Ceramics Division Oak Ridge National Lab. Oak Ridge, TN 37830). pp 727-735 of Thermal conductivity. Vol. 17. Hust, J.G. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106164—). Contract W-7405-ENG-26.

From National Bureau of Standards joint conferences: 8. symposium on thermophysical properties; 17. thermal conductivity conference; 8. thermal expansion conference; Gaithersburg, MD, USA (15 Jun 1981).

This chapter tests a simple concept for measuring thermal conductivity of flat insulations as a function of density and temperature, and compares results with studies on a pipe insulation tester. Explains that the technique consists of a flat Nichromescreen wire sandwiched between two samples and heated electrically. Shows through thermal modelling of this system that accurate measurements can be achieved with thermal conductivity down to 0.01 W/mXK and insulation thicknesses below 0.089 m (3-1/2 in.). Points out that measurement of thermal conductivity for material as thick as 0.305 m (12 in.) should also be possible with a lateral guard scheme to reduce heat flow along the screen wire heater.

33766 **EM study of the structure and composition of grain boundaries in (Mn,Zn) Fe_2O_4.** Lin, I.N.; Mishra, R.K.; Thomas, G. (Dept. of Materials Science and Mineral Eng., and the Materials and Molecular Research Division Univ. of California Berkeley, CA 94720). pp 351-358 of Advances in materials characterization. Vol. 15. Rossington, D.R.; Condrate, R.A.; Snyder, R.L. New York, NY; Plenum Publishing Corp. (1983). (CONF-820891—). Contract AC03-76SF00098.

From 18. ceramic science conference on advances in materials characterization; Alfred, NY, USA (16 Aug 1982).

This chapter examines the use of electron diffraction and microscopy studies supplemented by electron spectroscopic techniques such as Auger electron spectroscopy and energy dispersive x-ray spectroscopy to characterize the nature of grain boundary segregation in commercial grade (Mn, Zn)Fe_2O_4 samples containing small quantities of CaO. Finds that convergent beam electron diffraction experiments show that the crystal symmetry of the spinel structure is distorted in the vicinity of the grain boundary; that in-situ heating experiments in high voltage electron microscopy (HVEM) show the existence of a disordered phase at the sintering temperature; and that Lorentz microscopy in transmission electron microscopy (TEM) shows the interaction of magnetic domain wall motion with grain boundaries. Correlates these chemical and structural features with electrical resistivity and magnetic permeability of the ferrites.

33767 **Design criteria for prestressed concrete reactor vessels for high-temperature reactors.** Elter, C.; Becker, G. (Hochtemperatur-Reaktorbau GmbH, Gottlieb-Daimler-Strasse 8 6800 Mannheim 1). *Nuclear Technology;* **59**: No. 2, 228-233(Nov 1982).

For the design and construction of prestressed concrete reactor vessels, data on loading, construction materials, and safety factors are required. A description is given of the design conditions according to the current state of technology in the Federal Republic of Germany. Special consideration is given to the allowable stresses and an appropriate proposal for such stresses is suggested.

33768 **Near surface analysis of chromium implanted GaAs using RBS, PIXE, and TEM.** Pronko, P.P.; Holland, O.W.; Appleton, B.R.; Narayan, J. (Universal Energy Systems, Inc., Dayton, OH). *Proceedings - Electrochemical Society;* **81-82**: 855-856(1981). (CONF-811013—Vol.81-82-Absts). Contract W-7405-ENG-26.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33769 **Mass-spectrometric investigation of the plasma polymerization of hexamethyldisiloxane.** Hays, A.K. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 741-742(1981). (CONF-811013—Vol.81-82-Absts). Contract AC04-76DP00789.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33770 **Electron trap densities and chemical composition of APCVD silicon nitride.** Stein, H.J.; Kapoor, V.J. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **81-82**: 984-985(1981). (CONF-811013—Vol.81-82-Absts). Contract AC04-76DP00789.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33771 **Fundamentals and applications of aluminum chloride containing melts.** Blander, M.; Saboungi, M.L. (Argonne National Lab., IL). *Proceedings - Electrochemical Society;* **81-82**: 1048-1049(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

33772 **Thermochemistry of Na-K nitrate salts.** Mar, R.W.; Nagelberg, A.S. (Sandia National Laboratories, Livermore, CA). *Proceedings - Electrochemical Society;* **81-82**: 1050-1051(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

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33773 **(DOE/ER/04471—4) Dynamics of heat, mass and momentum transfer in an inductively coupled plasma. Final report, August 2, 1982-November 30, 1983.** Barnes, R.M. (Massachusetts Univ., Amherst (USA). Dept. of Chemistry). 23 Mar 1984. Contract AC02-77ER04471. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014121.

In the present research special attention has been given to the development of sophisticated mathematical models for the calculation of the flow and temperature fields in the induction torch under different operating conditions. The model originated by Boulos is particularly valuable since it is the only one which gives detailed information about the flow field as well as the temperature field in the plasma discharge through the solution of the two-dimensional flow and energy equations simultaneously with the one-dimensional electric and magnetic field equations. This model has been extended and refined substantially during the current research investigation, and its improvement and application to more complex practical conditions such as turbulent flow conditions and non-equilibrium processes is to be undertaken in new research.

33774 **(DOE/ER/04471—T2) Dynamics of heat, mass and momentum transfer in an inductively coupled plasma. Final report.** Boulos, M.I. (Sherbrooke Univ., Quebec (Canada). Dept. of Chemical Engineering). 24 Feb 1984. Contract AC02-77ER04471. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013499.

Objective over the last six years was to improve the understanding of the inductively coupled rf plasma which is used as an emission source in spectrochemical analysis. A brief overview is given of the research accomplishments. (DLC)

33775 (DOE/METC—84-8, pp 273-280) **Separation of gas mixtures by supported complexes.** Nov 1983. NTIS, PC A18/MF A01. Order Number TI84000217. (CONF-830641—).

From 3. annual advanced gasification projects contractors' meeting; Morgantown, WV, USA (28 Jun 1983).

The objective of this study is to define the most advantageous materials (both complex and support), methods of material preparation, material properties, and the performance of feasible supported complex systems in applicable gas separations. The project is well under way with the synthesis of 14 coordination complexes. Many of these complexes have been examined for their ability to reversibly sorb CO_2, CO, or H_2. The most promising complex so far has been $[Pd_2(dpm)_2Cl_2]$ where dpm = bisdiphenylphosphinomethane. The material has an exceedingly quick uptake of carbon monoxide. The rate of sorption is unaffected by the presence of other gases such as CO_2, H_2, N_2, and O_2. Further, the CO can be reversibly removed from the complex by the application of vacuum or heat (80°). Thus, it appears to be an excellent candidate for the selective removal of CO from a medium Btu gas stream. Attachment of procedures are nearing completion which will allow the respective complexes to polymeric supports. Polymeric attachment may enhance cycling life and delay complex degradation. 4 references, 3 figures, 1 table.

33776 **(INIS-BR—117) Determination of boron in water solution by an indirect neutron activation technique from a ^{241}Am/Be source.** Sales, H.B. (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear). Aug 1981. 71p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780334.

Boron content in water solutions has been analysed by Indirect Activation Technique a twin ^{241}Am/Be neutron source with a source strength of $9x10^6$ n/seg. The boron concentration was inferred from the measurement of the activity induced in a vanadium flux monitor. The vanadium rod was located inside the boron solution in a standard geometrical set up with respect to the neutron source. Boron concentrations in the range of 100 to 1000 ppm were determined with an overall accuracy of about 2% during a total analysis time of about 20 minutes. Eventhough the analysis is not selective for boron yet due the rapid, simple and precise nature, it is proposed for the analysis of boron in the primary coolant circuit of Nuclear Power Plants of PWR type.

33777 (INIS-BR—119, pp 36) **Activation analysis with charged particles.** Bellido, A.V.; Silva, A.G. da; Auler, L.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33778 (INIS-BR—119, pp 98-99) **Behavior of AISI 430 stainless steel in presence of chloride ions or sulphate ions.** Sebrao, M.Z. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33779 (INIS-BR—119, pp 118-120) **Determination of uranium and thorium in coal by epithermal neutrons.** Bernedo, L.F.B.; Castro Arezzo, B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

An experimental technique was developed aiming to determine uranium and thorium, in coal, using the activation analysis with thermal neutrons.

33780 (INIS-BR—119, pp 120-122) **Non destructive analysis of trace elements in coal by activation with resonance neutrons.** Bernedo, L.F.B.; Castro Arezzo, B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33781 (INIS-BR—119, pp 131-132) **Ores and minerals dating by mass spectrometry.** Carvalho, M.S. de; Mendonca, J.M.A. de; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33782 (INIS-BR—119, pp 111-112) **Beryllium fluorimetric determination.** Ferreira, C.A.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33783 (INIS-BR—119, pp 113-114) **Calorimetric determination of cerium and rare earths.** Dutra, P.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33784 (INIS-BR—119, pp 114-115) **Calorimetric determination of zirconium, thorium and rare earth in the same sample.** Dutra, P.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33785 (INIS-BR—119, pp 115) **Determination of niobium and tantalum/niobium mixtures.** Ferreira, C.A.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33786 (INIS-BR—119, pp 116) **Determination of fluorine in UF_4.** Ferreira, C.A.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33787 (INIS-BR—119, pp 116) **Fluor determination in uranium oxides.** Ferreira, C.A.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33788 (INIS-BR—119, pp 127-130) **Determination of helium impurities tracks by gas chromatography.** Luz, C.T.L.; Bellido, A.V.; Castro Arezzo, B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.
Impurities tracks, in the concentration range of 2 ppm to 10 ppm, in helium used for the formation of the inert atmosphere in fuel rods, are presented.

33789 (INIS-BR—119, pp 132-134) **Quantitative chemical analysis of impurities in uranium matrices by emission spectrography.** Clain, A.F.; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33790 (INIS-BR—119, pp 135) **Study of the ruthenium behavior in TBP systems, 30% (v/v) - dodecane/ruthenium complexes - HNO_3-H_2O.** Barreta, L.G.; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33791 (INIS-BR—119, pp 135) **Determination and optimization of the parameters in uranium extraction by solvents in a mixer - settler Pollux B-32.** Santos Filho, A.M. dos; Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.
In Annual Progress Report of 1981.

33792 (INIS-BR—120, pp 228-230) **Project of a hydrogen monitor for sodium loops.** Goncalves, A.C.; Souza, M.C.L.; Alleluia, I.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.
The construction of a monitor for the hydrogen content control in the sodium loops at IEN (Instituto de Engenharia Nuclear). (E.G.).

33793 (INIS-BR—120, pp 231-233) **Project of a distillator for sodium oxygen chemical analysis.** Goncalves, A.C.; Souza, M.C.L. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.
In Annual Progress Report of 1982.

33794 (INIS-mf—8903, pp 75) **Chlorine determination in EHC hydraulic fluid by activation analysis with thermal neutrons.** Nir-El, Y.; Lavi, N. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).
From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33795 (INIS-mf—8903, pp 199-200) **Concentration of some trace elements in malignant human lung tissue.** Shamai, Y.; Eisen, Y.; Even, O.; Weingarten, R.; Schlesinger, T. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Chaitchuk, S. (Tel Aviv Univ. (Israel). Medical School); Liberman, Y.; Haertzeg, E. (Sheba Medical Center, Tel Hashomer (Israel)); Weisberg, D. (Wolfson Medical Centre, Holon (Israel)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).
From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33796 (INIS-mf—8903, pp 201-204) **Quantitative X-ray fluorescence measurement of the stable iodine content in the thyroid gland.** Margaliot, M.; Schlesinger, T.; Eisen, Y.; Lubin, E. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Friedland, S.S. (Tel Aviv Univ. (Israel)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).
From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33797 (INIS-mf—8903, pp 205-206) **Determination of iodine in blood serum by epithermal neutron activation followed by gamma ray spectrometry.** Alfassi, Z.B. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Nuclear Engineering); Lavi, N. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).
From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33798 (INIS-mf—8921, pp 43) **Accelerator-mass spectrometry of long-lived radioisotopes using the Rehovot pelletron.** Kaim, R.; Goldberg, M. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics); Paul, N.; Meirav, O. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Henning, W.; Kutchera, W. (Argonne National Lab., IL (USA)); Kaufman, A.; Magaritz, M. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotopes). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).
From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).
Published in summary form only.

33799 (INIS-mf—8945) **Fast transport facility for activation analysis with high-energy neutrons.** Salahi, A. (Technische Univ., Vienna (Austria)). 1982. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780335.
In 1981 Dams and Fanger have shown that for neutron activation analysis nearly all elements have potential short-lived nu-

clides, where different irradiation techniques are applied. To increase the range of analytical application the activation can be performed also with 14 MeV neutrons to obtain a higher sensitivity for a number of interesting elements like O, Si, P, K, As, Y, Ba and Pb. To utilize a high neutron flux density for fast and thermal neutron activation analysis with short-lived radionuclides a rapid He-transfer system has been developed for the central thimble of the TRIGA Mark-II reactor at the Atomic Institute of Austrian Universities, Vienna, Austria. The rapid transfer system is provided with a ^{6}LiD-converter in the irradiation position. In this system a special stopping device is inserted at the counting position. The capsules are injected into the transport tube by means of an automatic capsule changer and the irradiation sequence is controlled by a micro-computer. With a reproducibility of less than 1 ms transfer times of 32 to 35 ms have been obtained over a distance of 8.5 m for gas-tube pressures of 0.8 to 1 MPa.

33800 **(INIS-mf—8956) Quantization of secondary ion mass spectrometry (SIMS) data using external and internal standards.** Gnaser, H. (Technische Univ., Vienna (Austria)). 1983. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780390.

Some aspects of multi-dimensional characterization of solids by secondary ion mass spectrometry (SIMS) are given. A theoretical part discusses methods for the quantization of SIMS data and the most prominent effects of ion-solid interactions as related to SIMS. After a description of the instrument used for experiments (a quadrupole-equipped ion microprobe featuring a liquid metal ion source in addition to the standard duoplasmatron gas ion source) the first experimental section is devoted to the determination of practical sensitivities and relative sensitivity factors for selected pure elements, binary and treary alloys and multicomponent systems. For 23 pure elements practical sensitivities under O^{+}_{2} bombardment also have been compared to those under In^{+}-bombardment; it was shown that on oxygen saturated surfaces yields under In^{+}-bombardment are higher, this making feasible use of submicron In-beams for surface analysis. In the second experimental section boron implants in silicon have been used for studying depth profiling capabilities of the instrument. Sputtering yields of Si and degrees of ionization of both B and Si have been measured. It has been shown that implantation profiles may deviate considerably from Gaussian but can be described by means of mathematical distribution functions. In the third experimental section depth resolution of the erosion process has been studied by profiling a Ni/Cr multilayer sample (100 A single layer) and been found to be approximately constant over the depth range investigated. Quantization of depth profiles, usually distorted by matrix effects, has been attempted using the primary beam species (In) as internal implantation standard. Some problems in connection with the conversion of secondary ion micrographs to concentration maps are discussed. Elemental detection limits in multidimensional SIMS analysis are given in dependence of primary beam size and total eroded depth. (Author).

33801 **(INIS-mf—8973) Applications of EHD-ion sources in SIMS.** Studnicka, H. (Vienna Univ. (Austria). Formal- und Naturwissenschaftliche Fakultaet). 1983. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780349.

Because of their high brillance and their small energy spread EHD ion sources are well qualified for focused ion beams. This work describes the build-up and the main properties of a designed indium EHD ion source. It is used as primary gun in a scanning ion microprobe. The advantages of this new source instead of a O_2 - duoplasmatron ion source are described and demonstrated by selected examples. (Author).

33802 (INIS-SU—198, pp 568) **X-ray fluorescence analysis of low-content impurities of gold.** Mekhedov, B.N.; Risin, V.E.; Shalin, A.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

33803 (INIS-SU—198, pp 587) **Account of summation effects of cascade gamma-quanta in determining the activity of large bulk samples.** Vojtov, A.I.; Matsepulina, E.I.; Polyanskij, A.L.; Poyarkov, V.A.; Strizhak, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

33804 **(IS-M—476) Relation of vertical intensity profiles for neutral atom lines to analyte atomization behavior in inductively coupled plasmas.** Houk, R.S. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 15p. (CONF-840101—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014126.

From Winter conference on plasma spectrochemistry; San Diego, CA, USA (2 Jan 1984).

Emission lines from neutral atoms exhibit their maximum intensities at observation heights that vary considerably from element to element. In this paper, vertical spatial profiles of neutral atom number density are derived from the corresponding experimental intensity profiles using a simple model based on a Boltzmann distribution of excited state populations. These number density profiles indicate that element-to-element differences in the height range in which analyte atomization and ionization occur are partly responsible for the normal temperature phenomenon noted above. The effects of forward power on the range of observation heights in which neutral atom lines peak is also described.

33805 **(LA—10061-SR) Materials Science and Technology (MST) Division, Nuclear Materials Process Technology Group (MST-12), chemical process research and development report.** Clifton, D.G. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014143.

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A process for the recovery of plutonium and americium from molten salt extraction (MSE) salt residues has been demonstrated. It is based upon a new chloride anion-exchange process at low acidity that eliminates corrosive HCl fumes. The Los Alamos americium oxide production line has been improved to give more product with a concurrent lowering of personnel radiation exposure. A cost study has been made for the disposal of americium-contaminated calcium metal buttons that were obtained by pyrochemical recovery of plutonium from MSE salts. The waste form used in the study conforms to WIPP-Facility standards and current state-of-the-art radioactive waste disposal. The cost estimate is ~ \$300/g ^{241}Am. Plutonium decontamination factors of ~ 300 have been obtained from lead-platinum alloy dissolution experiments carried out in alumina crucibles using lead oxide slag to getter the plutonium.

33806 **(LBL—16604) Radial distribution function as an analysis technique.** Pearson, A.W. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013242.

Portions are illegible in microfiche products; Thesis.

Diffraction patterns for Cu as found in a perfect fcc lattice were generated for various particle sizes and shapes using a computer model based on the Debye-Sum. These patterns were Fourier transformed to yield the radial distribution function $G(R) = 4\pi R(\rho(R)-\rho_0)$. This function was studied in relation to five variables, i.e., (1) particle size, (2) particle shape, (3) scattering vector termination, (4) the influence of small angle scattering due to sample size and, (5) effect of vibrational atomic displacements. Particle sizes of up to 30A were found to influence G(R) as related to determination of the first coordination shell. The effect of volume scattering was to displace the G(R) curve negatively, but neither peak position nor area were affected. The measurement of ρ_0 was affected and the effective ρ_0 present with SAXS removed must be taken into account when calculating coordination shells.

33807 **(PB—84-181981) Laser micropyrolysis of coal macerals. Annual report Nov 82-Oct 83.** Vastola, F.J.; Bogdan, M. (Pennsylvania State Univ., University Park (USA)). Feb 1984. 72p. NTIS, PC A04/MF A01.

See also PB83-244020.

The mass spectra of the pyrolysis products of coal macerals have been obtained by heating the macerals, in monolithic coal sections with focused laser radiation. The technique has been used for analysis of the vitrain maceral of 27 coals. The pyrolysis mass spectra indicated the presence of alkyl- and hydroxy-substituted benzenes and napthalenes. Higher molecular weight compounds (beginning with substituted anthracenes) were not detected. All of the pyrolysis products can be accounted for by breaking the weakest bonds in a structure and, if sufficient hydrogen was available, abstraction of hydrogen. This model suggests that vitrinite is predominantly composed of many alkyl- and hydroxy-substituted benzenes and naphthalenes linked by aliphatic bridges. The chemical information in the laser pyrolysis mass spectra was examined for possible correlations to rank, vitrinite reflectance, regional variations and other physical parameters. The strongest correlation of the mass spectra regardless of coal region was with the free swelling index of the coals. Coals which swell have an abundance of alkylaromatics as pyrolysis products; those which do not swell were void of alkylaromatics. The formation of alkyl-aromatics was attributed to the pyrolysis of aliphatic bridges between aromatic nuclei. An inverse relationship was also detected between the pyrolysis product 2-propenal (acrolein) and the free swelling index of the coal.

33808 **(PB—84-182203) Coadsorption studies on transition metals. Annual report 1 Jan-31 Dec 83.** Craig, J.H. Jr. (Nebraska Univ., Omaha (USA)). Mar 1984. 16p. NTIS, PC A02/MF A01.

Surface mass spectroscopy was used to study adsorption and coadsorption of active gases on several transition metals. Electron and ion stimulated desorption were employed in conjunction with thermal desorption spectroscopy. It was found to be possible to correlate specific adsorption states for CO on nickel with release of particular ionic species by electron and ion impact. For coadsorbed H_2 and CO on nickel, an $(NiOH)^{+1}$ species was observed by ion induced desorption which was interpreted as evidence for interaction between adsorbates. Coadsorption of H_2 and CO on rhodium resulted in appearance of a new high temperature mass 2 thermal desorption state. Electron desorption of $(OH)^{+1}$ along with modification of the $(O)^{+1}$ energy distribution during coadsorption indicated presence of a strong interaction between adsorbed H_2 and CO.

33809 **(PNL-SA—12032) Separation of gas mixtures with coordination complexes.** Nelson, D.A.; Hallen, R.T.; Lilga, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 13p. (CONF-840828—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008314.

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

Several coordination complexes were examined for their ability to reversibly sorb CO_2, CO, or H_2. Three of those complexes appeared worthy of further investigation. Carbon dioxide was rapidly bound by crystalline $IR(dmpe)_2Cl$ within 10 seconds. Desorption of CO_2 was achieved with heat and decreased pressure. The series $Pd_2(dpm)_2X_2$, where X = Cl, Br, I, and NCO, was found to be of considerable interest for CO sorption. Sorption of CO was rapid and the kinetics appeared to be quite favorable. The kinetics were not influenced by the presence of CO_2, N_2, O_2, H_2, ethylene or acetylene. Thus, $Pd_2(dpm)_2X_2$ showed considerable specificity for CO. Hydrogen, oxygen, and carbon monoxide were sorbed by $Ru(CO)_2(PPh_3)_3$; however, the complex required that a phosphine ligand be released prior to gas coordination. The kinetics of these reactions indicated that H_2 was bound twice as fast as CO and seven times faster than O_2.

33810 **(ORNL-tr—5125) Separation of volatile elements and oxides: thermochromatography and the use of chemical filters.** Zhuykov, B.L. (Oak Ridge National Lab., TN (USA); Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. Contract AC05-84OR21400. C; P12-82-63, 1982. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012869.

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The possibilities of gas-chemical separation of elements of the periodic system by alternation of gas phase composition (hydrogen,oxygen), temperature (thermochromatography, a moving temperature gradient) and composition of stationary phase (quartz, stainless steel, gold, calcium oxide) are considered. Thermochromatographic separation of numerous elements in hydrogen or oxygen stream is performed in a carrier-free state and in the presence of a carrier up to milligram quantities. Adsorption heat on different surfaces is calculated. Absorption of volatile in oxygen stream elements by a CaO filter (1100°C) is examined. Complete absorption of F, As, Sb, Bi, Te, Po, In, Mo, Tc, Ru; partial absorption of Re, Rh, Ir, Pt; practically no absorption of Br, I, At, Se, Pb, Tl, Zn, Cd, Hg, Os are observed. Complete separation of At and halogens by thermochromatography on CaO is achieved. The use of these methods in different fields of radiochemistry is discussed. The investigation has been performed at the Laboratory of Nuclear Reactions, JINR.

33811 **Gas-absorption process.** Stephenson, M.J.; Eby, R.S. (to Dept. of Energy). Canadian Patent 1,090,539. 2 Dec 1980. Priority date 18 Jul 1977, United States of America (USA), vp.

Gas-absorption processes (i.e., processes in which a gas mixture is contracted with a liquid absorbent (solvent) for preferentially dissolving one or more components of the mixture are described. More particularly, continuous gas-absorption processes are provided in which a liquid absorbent is circulated continuously through a closed-loop system which includes gas-absorption, gas-desorption, and absorbent-regeneration zones. 10 claims.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 32785, 34145

33812 **(CONF-840415—25) Intramolecular dynamics of highly excited OCS.** Davis, M.J.; Wagner, A.F. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013444.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

The intramolecular dynamics of highly excited OCS has been studied within the framework of classical mechanics. One study involves the energy relaxation of OCS restricted to planar geometry. A second study investigates the unimolecular dissociation of OCS. It has been found that the relaxation of OCS is slow and appears to occur on two time scales. In addition, the relaxation still persists at 45 ps. Reasons for such an effect, as well as diagnostic techniques, are discussed. Since the causes for such effects persist above dissociation, they lead to nonstatistical unimolecular dissociation, which also shows a high degree of mode specificity.

33813 **(DOE/PC/60812—T1) Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Preliminary progress report, August-September 1983.** Massoth, F.E.; Shabtai, J.S. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 31 Oct 1983. Contract FG22-83PC60812. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012968.

The aim of the proposed research is to synthesize and investigate new sulfided catalyst systems having higher carbon-heteroatom hydrogenolysis activity as compared to ring hydrogenation activity. A fundamental approach is planned to gain understanding of the basic catalytic properties which relate to hydrogenolysis, hydrogenation and cracking functions of the catalysts. This will involve preparation of new catalysts, characterization of their properties and model compound reactivity studies. In another part of the project, selected catalysts will be applied in studies of more complex O- and N-containing model compounds with the objective of providing fundamental data on the stereochemistry of HDO and HDN reactions. These data will be used to develop steric surface-reactant models for sulfided catalysts. These new catalysts should be of particular importance for upgrading of coal-derived liquids and solids, as well as other heavy feedstocks. The research is divid-

ed into four tasks: (1) catalyst preparation and activity testing; (2) catalyst characterization; (2) study of catalyst activity under hydroprocessing conditions; and (4) stereochemical studies. This report covers a period of only one month. Work was initiated on catalyst preparation. A brief literature search was made to ascertain what different preparation methods can be applied to supported sulfide catalysts besides the standard wetness method. Several Cr/Al_2O_3 catalysts containing Co or Ni were prepared by the standard impregnation method. 3 references.

33814 **(EGG-SCM—6567) Dehydration of aluminum chloride hexahydrate: a technical assessment.** Miller, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1984. Contract AC07-76ID01570. 48p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013086.

Physical and chemical properties of aluminum chloride hexahydrate, ACH, and related compounds are noted as well as the relation of these properties to the problem of dehydration of ACH to form anhydrous aluminum chloride. Several approaches to the dehydration of ACH are discussed and a rationale or each approach is given: solvent extraction, ligand exchange, azeotropic distillation, chemical dehydration, and energy specific direct heating. While the thermodynamics of dehydration are frequently favorable, the rate of reaction and the mechanisms of reaction are more frequently unfavorable. However, each approach requires experimentation to test its effectiveness. The stability of the aluminum-oxygen bond in the hydrate is such that dehydration without decomposition to the oxide will be very difficult.

33815 (INIS-mf—8921, pp 59) **Effect of diborane and phosphine on the deposition rate of silicon grown from $SiCl_4$ by R.F. plasma.** Manory, R.; Grossman, E.; Avni, R.; Grill, A. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

Published in summary form only.

33816 **(IS-M—491) New materials from high temperature synthesis.** Corbett, J.D. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 17p. (CONF-8404110—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014125.

From 4. international conference on high temperature science - HYTHERM; Santa Fe, NM, USA (2 Apr 1984).

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Over 40 new and remarkable types of metal-rich compounds have been synthesized since about 1970 by high temperature reactions. These are found in binary and ternary systems of the early (group III-VI) transition and lanthanide elements with the nonmetals Cl, Br, I, O, S, Se or Te. Metal-metal bonding is characteristic of all the structures. These are conveniently organized in terms of the presence of discrete clusters of four to six metal atoms or their condensation products in the form of extended clusters, infinite chains of clusters sharing faces or edges, or double-metal-layered sheets. All the metal structures are well bound by nonmetals in relatively specific ways. Several recent discoveries also involve small nonmetal atoms interstitially bound within the metal units. A range of examples is discussed and illustrated. Some developing concepts and principles involving structural, bonding and electronic regularities and effects and some of the experimental aspects are also considered.

33817 **(LA-UR—84-1041) Selective epoxidation of ethylene catalyzed by silver. Mechanistic details revealed by single-crystal studies.** Campbell, C.T. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-840805—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009987.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

The selective oxidation of ethylene to ethylene epoxide ($C_2H_4 + 1/2\ O_2 \rightarrow C_2H_4O$) over Ag is a simple prototype for the entire class of kinetically-controlled, selective oxidation reactions. We have studied the steady-state kinetics and selectivity of this reaction on clean, well-characterized single-crystal surfaces of silver by using a special apparatus which allows rapid (approx. 20 s) transfer between a high-pressure catalytic microreactor and an ultra-high vacuum surface analysis (AES, XPS, LEED, TDS) chamber. The results of some of our recent studies of this reaction are reviewed. These single-crystal studies have provided considerable new insight into: the reaction pathway through molecularly adsorbed O_2 and C_2H_4, the structural sensitivity of real silver catalysts, and the role of chlorine adatoms in promoting catalyst selectivity.

33818 **(PB—84-179746) Experimental studies of the geometric and electronic structure of chemisorption bonding. Annual report Jan-Dec 83.** Gustafsson, T.; Plummer, E.W. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Feb 1984. 17p. NTIS, PC A02/MF A01.

See also PB83-243949.

The chemisorption of small molecules on carefully prepared alloy surfaces has been studied using angle-integrated and angle-resolved photoelectron spectroscopy, as well as with more conventional techniques such as thermal desorption and low energy electron diffraction. The specific system investigated this year was the (110) face of the surface alloy NiAl. Simply stated the objective is to separate or correlate the electronic and geometric factors governing chemisorption on bimetallic systems as a first step towards understanding the selectivity of multi-component catalysts. The chemisorption properties of the NiAl surface are fascinating.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 32450, 32486, 32519, 32650, 32671, 32796, 33741, 33769, 33775, 33813, 34355, 34782

33819 **(DOE/ER/10641—2) Heats of formation of gas phase organosulfur molecules radicals and ions measured by Pipeco. Progress report, August 1981-May 31, 1982.** Baer, T.; Evans, S.A. (North Carolina Univ., Chapel Hill (USA). Dept. of Chemistry). 1982. Contract AS05-80ER10641. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012949.

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The O° K heats of formation ($\Delta H°$/sub fo/) in kcal/mol of CHS^+ (233), CH_2S^+ (235), CH_3S^+ (215), $C_2H_3S^+$ (217), $C_2H_4S^+$ (222), $C_3H_5S^+$ (214), and $C_4H_7S^+$ (241) have been measured by dissociative photoionization of a number of precursor molecules. Because the $\Delta H°$/sub fo/ ($C_2H_4S^+$) is significantly lower than the known $\Delta H°$/sub fo/ (c-$C_2H_4S^+$) of 232 kcal/mol, we conclude that the $C_2H_4S^+$ product ion has the thioacetaldehyde structure. Combining this with the known ionization energy of thioacetaldehyde gives us the first experimentally measured heat of formation of the thioacetaldehyde molecule which was found to be 15 kcal/mol at O° K. This compares to a $\Delta H°$/sub fo/ (C_2H_4S) = 23 kcal/mol. Another study involved some of the oxygen analogues of the above sulfur compounds. We have synthesized a new series of vinyloxy sulfides, sulfoxides, and sulfones and have obtained estimates of the π electron distribution at the vinylic carbons using ^{13}C NMR spectoscopy. These results have significant implications regarding the strength of S-C bonds in unsaturated organosulfur molecules capable of exhibiting enhanced stability resulting from $(2p \rightarrow 3d)\pi$ overlap compared to the saturated analogs. An ^{33}S NMR investigation of some of the organosulfur compounds indicate that conversion of sulfenyl sulfur to sulfonyl sulfur (-S- → -SO_2 -) causes the ^{33}S line widths to diminish so that rapid and accurate sulfur analyses (as sulfones) of organosulfur constituents in coal and petroleum are possible.

33820 **(DOE/ER/10641—3) Heats of formation of gas phase organosulfur molecules, radicals and ions measured by PEPICO, and application of ^{17}O and ^{33}S NMR spectroscopy to structure determinations of organosulfur compounds. Progress report, June 1, 1983-April 15, 1984.** Baer, T. (North Carolina Univ., Chapel Hill (USA). Dept. of Chemistry). 1984. Contract AS05-80ER10641. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013131.

A number of fragment ion onsets from the photoionization of $CH_3SCCSCH_3$ and CH_3SSSCH_3 have been measured. In addi-

tion, our experiment has been converted to a molecular beam source which will increase the precision of our measurements. Exhaustive oxidation of the divalent sulfur to sulfonic acids serves to quench the effects of quadrupolar broadening and thereby allowing for quantitative evaluation of structurally similar sulfonic acids. W/ sub 1/2/ are reduced to < 25 Hz at 19 MHz (57,500 Gauss). Electronegative substituents shield the ^{33}S nucleus perhaps imploying more efficient 2p-3dπ backbonding between sulfur and oxygen. α-Hetero substituents of sulfonyl groups do not influence the shift of the ^{33}S to a dramatic extent. The exception is the dianion of thiosulfate compared to the dianion of sulfate. Lanthanide shift reagents, [Eu(fod)$_3$], are potentially useful in distinguishing sulfonyl ^{17}O shifts from those of ethereal ^{17}O shifts.

33821 **(IS-M—473) Reduced molybdenum states in hydrodesulfurization: investigations using Chevrel phase catalysts.** McCarty, K.F.; Schrader, G.L. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 10p. (CONF-840748—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012309.

From 8. international congress on catalysis; Berlin, F.R. Germany (2 Jul 1984).

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A series of reduced molybdenum sulfides known as Chevrel phases were used as catalysts for thiophene hydrodesulfurization and were determined to have desulfurization activities comparable to model molybdenum sulfide catalysts. Cobalt, iron, copper, and holmium ternary compounds were prepared with unusual promotional activity for holmium and copper. Hydrogenation and cracking activities of all Chevrel phase catalysts were observed to be very low. Characterization by x-ray diffraction, laser Raman spectroscopy, and XPS demonstrated that the catalysts were stable under reaction conditions. Oxidation states for molybdenum less than that for MoS_2 were detected.

33822 **(IS-T—1106) Comparison of the ozonolysis products of the methylnaphthalenes and dimethylnapthalenes in hexane, methanol, and water.** Gaul, M.D. (Ames Lab., IA (USA)). Jun 1984. Contract W-7405-ENG-82. 309p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84013981.

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The ozonolyses of 1- and 2-methylnaphthalene and 1,2-, 1,3-, 1,4-, and 2,3-dimethylnaphthalene were performed in dilute aqueous solution, and the products which resulted were compared to products from similar reactions performed in n-hexane and methanol. Gas chromatography, gas chromatography-mass spectrometry, and gas chromatography-Fourier transform infrared spectrometry were used. All products characterized in the three solvents resulted from the normal ozonolysis of either one or two double bonds in the naphthalene ring system. Products resulting from the ozonolysis of two double bonds were typical. Products which resulted from the ozonolysis of only one double bond were not expected. Reactions in water yielded large amounts of these mono-ozonolysis products compared with the reactions in n-hexane and methanol. A second major difference in the aqueous ozonolyses was that these reactions yielded aldehydes and ketones exclusively as products. The reactions in the organic solvents contrasted sharply with the reactions in water by yielding large amounts of carboxylic acids as well as aldehydes and ketones.

33823 **(PB—84-175025) Stoichiometric CO reduction by supported metal carbonyls. Annual report Dec 82-Jan 83.** Shriver, D.F. (Northwestern Univ., Evanston, IL (USA). Dept. of Chemistry). Jan 1984. 11p. NTIS, PC A02/MF A01.

The overall project objective is to study stoichiometric reactions on supported organometallic complexes with emphasis on the reduction of carbon monoxide. Previous work in their laboratory has shown that the homogeneous proton-induced reduction of CO to CH4 in metal carbonyls in neat super acid is greatly dependent on the metal cluster nuclearity. A study of the effect of metal nuclearity on the heterogeneous reduction of CO should provide insight on the physical requirements for CO reduction. Ways to improve product selectivity in this complex reaction may also result from such a study.

33824 **Catalysis by solvated transition-metal cations. 3. Novel catalytic transformations of alkenes by cationic compounds of molybdenum and tungsten.** Sen, A.; Thomas, R.R. (Pennsylvania State Univ., University Park). *Organometallics;* 1: 1251-1254(1982). Contract AC02-81ER10992.

The compounds $[M(NO)_2(CH_3CN)_4](BF_4)_2$; (2, M = Mo; 3, M = W) were synthesized through reactions of the corresponding metal hexacarbonyls with 2 equiv of $NOBF_4$ in acetonitrile. These compounds catalyze the polymerization, oligomerization, and rearrangement of olefins. 13 references, 2 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 32447, 32560, 33376, 33377, 33698, 34473

33825 **Oxygen electrochemistry.** Tarasevich, M.R.; Sadkowski, A.; Yeager, E. (Inst. of Electrochemistry of the Academy of Sciences of the USSR Leninsky Prospekt 31, Moscow V-71). pp 301-398 of Comprehensive treatise of electrochemistry. Vol. 7. Conway, B.E.; Bockris, J.O'M.; Khan, S.U.M.; White, R.E.; Yeager, E. New York, NY; Plenum Publishing Corp. (1983).

This chapter examines oxygen electrochemistry in aqueous systems. Discusses thermodynamics of the oxygen electrode; open-circuit potentials; oxygen adsorbed species and anodic films on platinum and other noble metals (electrochemical studies, in situ optical studies, in situ surface conductivity measurements; ex situ characterizations); the anodic oxygen evolution reaction (kinetics and mechanisms of the oxygen evolution reaction on metal and oxide electrodes); and cathodic reactions of oxygen (the general scheme of parallel and series reactions of oxygen and hydrogen peroxide; the kinetics of molecular oxygen reduction on different metallic electrodes; oxygen reduction on nonmetallic materials). Concludes that despite the large research effort and extensive literature on the O_2 electrode reactions, the mechanisms remain mostly a matter of speculation and the relationship of the electrocatalytic activity to surface electronic properties and morphology uncertain.

4005 Photochemistry

REFER ALSO TO CITATION(S) 33826

4006 Radiation Chemistry

33826 **(DOE/ER/03106—85) Radiation chemistry of hydrocarbon and alkyl halide systems. Annual progress report, August 1, 1983-May 31, 1984.** Hanrahan, R.J. (Florida Univ., Gainesville (USA)). 1984. Contract AS05-76ER03106. 42p. (ORO—3106-85). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013639.

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Work in progress includes studies of gas phase OH radical reactions using argon sensitized pulse radiolysis; studies of the radiolytic oxidation of propane; and an investigation of the photochemistry and mass spectrometry of CF_3I-CH_3I mixtures. Two new investigations of the radiolytic oxidation of butane and of I_2 scavenging in hydrocarbon radiolysis are still in early stages. Work on interpretation and analysis of data on the H_2/CO system is still in progress.

33827 (INIS-mf—8927, pp 87-92) **Radiation chemistry.** Plander, E. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780240.

In 60 years of the Institute for Research, Production and Application of Radioisotopes 1919-1979.

The responsibilities are briefly described of the radiation chemistry department. The possibilities of modifying the properties of different materials upon the action of ionizing radiation, radiation isomerization, radiation polymerization and radiation synthesis are studied. (M.D.).

33828 (INIS-mf—8927, pp 61-68) **Metrology of radionuclides.** Kokta, L. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780240.

In 60 years of the Institute for Research, Production and Application of Radioisotopes 1919-1979.

The department of dosimetry of the Institute is involved in the absolute measurement of radionuclide activity. The laboratory equipment is briefly described and the main types of manufactured standards are listed. (M.D.).

33829 (INIS-SU—222, pp 65-67) **Kinetics of radioluminescence of beryllium oxide.** Viktorov, L.V.; Gavrilov, K.F.; Giniyatulin, K.N.; Kruzhalov, A.V. (Ural'skij Politekhnicheskij Inst., Sverdlovsk (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

Spectral and kinetic radioluminescent characteristics of Be0 crystals and powders are studied (roentgen or electron irradiation). The influence of high-temperature annealing and dopping with ions of lithium on behaviour of luminescent peaks: 3.9 eV; 4.3 eV and 4.6 eV have been found. Three components with different kinetic parameters are revealed in the 4.6 eV band. Rapid component (70 nc) shows high stable temperature behaviour. It is suggested, that the investigated emission bands are connected with both dopping lithium and beryllium vacancies.

33830 (INIS-SU—222, pp 33-35) **Role of admixed hydroxyl groups in the processes of formation of radiation defects in oxides of alkaline earth elements.** Spitsyn, V.I.; Barsova, L.I.; Yurik, T.K.; Zyazyulya, I.I. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

The EPR and IR-spectroscopy methods have been used for a study of the influence of admixed hydroxyl groups on the radiation (γ-radiation) stability of monocrystals and polycrystals of magnesium and calcium oxides. It was shown that in monocrystals of high content of OH^- ions the radiation induced proton diffusion processes occur. In polycrystals a system of admixed hydroxyl groups is necessary for emerging of the Vsub(OH)-centers, but contribute to the tunnel transfer of Fsub(s)sup(+)-centers.

33831 (INIS-SU—222, pp 56-57) **Radiation-chemical conversion of radiolysis products under high-temperature irradiation in alkali-halide crystals.** Shvarts, K.K.; Ehkmanis, Yu.A.; Rabsha, S.Ya. (AN Latvijskoj SSR, Riga. Inst. Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780272.

In Physics of radiation damage and radiation material science.

The high-temperature (400-1000 K) radiolysis processes under electron (3.5 MeV) irradiatior (10^2-5.10^4 Mrad) has been analysed. Complicated temperature dependence of this process was shown which has been conditioned by coagulation and destruction of electron products of radiolysis and by their stabilization with oxygen from surrounding atmosphere.

33832 **(KFK—3639) Investigation of the radiolytic TBP degradation under Purex process conditions.** Becker, R.; Stieglitz, L.; Bautz, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Dec 1983. 57p. (In German). (PWA—66/83). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751437.

We tried to choose experimental conditions similar to these of the process. In the absence of uranium the rate of the HDBP-formation increased slightly with the acid concentration. After the addition of uranium (Csub(org.)approx.=35 g/l) this dependence disappeared. Irradiations which were carried out under gas atmospheres (N_2, O_2, N_2O) showed only in the presence of N_2O a significantly diminished HDBP formation. For the TBP degradation in aqueous solutions (3 M HNO_3) we found an exponential decrease of the TBP concentration with an increasing radiation dose. The formation rates of H_2MBP and H_3PO_4 were 0,99 mg/Wh (org.) and 0,59 mg/Wh (aq.) for H_2MBP and 4,88 gm/Wh for phosphoric acid. They were considerably lower than those of the HDBP formation. The "G-values" of the safety relevant H_2, CH_4, C_2H_6, C_3H_8 and C_4H_{10} which are produced by the radiolytic solvent degradation too were determined. The G-value found for the hydrogen formation was 0,75, the corresponding values for the gaseous hydrocarbons lied between 2×10^{-2} and 2×10^{-3}. The chemical nature of the complex forming radiolysis products, which accumulate in recycled solvents was elucidated. Long chain acid organophosphates could be identified as the compounds that we looked for. Besides that polycarbonyl compounds could exist in low concentrations too. For the degradation of the alkane diluent the simple semi-quantitative analytical methods were developed in order to gain informations about the concentrations of the interesting compound classes. After a suitable sample pretreatment long chain acid organophosphates, carboxylic acids and diketones in the enol form are determined by the measurement of the electrolytic conductivity. The pulse polarographic investigation of irradiated solvent samples allows the estimation of the concentration of nitroalkanes and alkylnitrates.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 32702, 33805, 33810

33833 **(FRNC-TH—1586) Study of hyperfine interactions in neptunium chalcogenides: NpS_3, $NpSe_3$, Np_2Se_5, Np_3S_5 and Np_3Se_5 by neptunium 237 Moessbauer resonance.** Thevenin, T. (Paris-11 Univ., 91 - Orsay (France)). Apr 1982. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751551.

In this work are studied magnetic properties and hyperfine interactions of neptunium sulfides and selenides. The variation of magnetic susceptibility with temperature and Moessbauer resonance of Np237 are measured. Np_2Se_5 is evidenced for the first time and monocrystals of NpS_3 are prepared. Thermal variations of magnetic susceptibility and Moessbauer resonance show a magnetic order at low temperature in NpS_3 (45 K), $NpSe_3$ (55 K), Np_2Se_5 (15 K), Np_3S_5 (13-17 K) and Np_3Se_5 (26 K). Charge of neptunium is given by isomer shifts of Moessbauer resonance spectra, in NpS_3, $NpSe_3$ and Np_2Se_5 neptunium is tetravalent, in Np_3S_5 and Np_3Se_5 charges III and IV are found in the ratio 2/1. Isomer shifts show also the influence of anion electroaffinity and coordinence on the electronic density of neptunium ions.

33834 (INIS-BR—119, pp 54-58) **Production of ^{123}I.** Britto, J.L.Q. de; Silva, A.G. da; Teixeira, F.C.M.; Costa e Silva, A.; Souza, A.S.F. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The ^{12}I is prepared by $^{122}Te(^3He, 2n)^{123}Xe$ sup($\beta+$) $\rightarrow$ ^{123}I reaction.

33835 (INIS-BR—119, pp 58-63) **Production of ^{111}In.** Osso Junior, J.A.; Silva, A.G. da; Costa e Silva, A.; Teixeira, F.C.M.; Souza, A.S.F. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The method used to produce ^{111}In, irradiating an Ag target with currents of 23μA of 28 MeV alphas during two hours, is described.

33836 (INIS-BR—119, pp 63-66) **Production of ^{201}Tl.** Braghirolli, A.M.S.; Silva, A.G. da; Teixeira, F.C.M.; Costa e Silva, A.; Souza, A.S.F. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The obtention of ^{201}Tl, free of charger and impurities, with large target yield of 1,7 mCi/μAh of ^{201}Pb, precursory of ^{201}Tl, and with 93% yield for chemical separation of ^{201}Tl, is related.

33837 (INIS-BR—119, pp 66-72) **Production of ^{77}Br.** Bastos, M.A.V.; Silva, A.G. da; Costa e Silva, A.; Teixeira, F.C.M.; Souza, A.S.F. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The production of bromine-77 in the cyclotron of Institute of Nuclear Engineering (IEN) by $^{75}As(\alpha, 2n)^{77}Br$, is described.

33838 (INIS-BR—119, pp 71-79) **Production of ^{67}Ga.** Chamma, D.F.S.; Silva, A.G. da; Weinreich, R.; Teixeira, F.C.M.; Costa e Silva, A.; Souza, A.S.F. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The obtention of gallium 67 from a target of metallic zinc, with 0,55 mm of thickness and a incident proton beams of 24 MeV, in CV-28 cyclotron at Institute of Nuclear Engineering (IEN), is described. The reactions used are $^{68}Zn(p, 2n)^{67}Ga$ and $^{67}Zn(p, n)^{67}Ga$.

33839 (INIS-BR—119, pp 79-80) **Production of ^{55}Fe.** Osso Junior, J.A.; Teixeira, F.C.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33840 (INIS-BR—119, pp 109-111) **Uranium-III production - and stability.** Macedo, S.H.G. de; Rodrigues Filho, J.S. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The uranium-III production is studied by two processes: direct reduction of UO_2Cl_2 by zinc liquid amalgam and electrolytic reduction.

33841 (INIS-mf—8903, pp 208) **Organ-distribution and biochemical aspects in developing new radiopharmaceuticals labelled with metallocenes.** Wenzel, M. (Freie Univ. Berlin (Germany, F.R.). Isotopen-Abt.). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33842 (INIS-mf—8927, pp 77-85) **Analytical chemistry.** Svoboda, V.; Matucha, M. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780240.

In 60 years of the Institute for Research, Production and Application of Radioisotopes 1919-1979.

The Institute's department of analytical chemistry is responsible for the analysis of organic compounds and radiopharmaceuticals, the emission spectrographic analysis of materials, the analysis of inactive mixtures formed by radiation chemical synthesis, and for radiometric analysis methods. A method was developed of analysis of ^{14}C- and ^{3}H-labelled compounds. Many special instruments used for the said tasks have been designed at the Institute. (M.D.).

33843 (INIS-mf—8927, pp 37-45) **Labelled organic compounds.** Kolina, I.; Filip, I. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780240.

In 60 years of the Institute for Research, Production and Application of Radioisotopes 1919-1979.

The results are described obtained in research and production of labelled organic compounds. The programme is mainly oriented to the preparation of nucleic acids, proteins and saccharides labelled with ^{3}H and ^{14}C. Some labelling methods and compounds prepared are briefly characterized. (M.D.).

33844 **Educational laboratory experiments on chemistry in a nuclear engineering school.** Akatsu, E. (Japan Atomic Energy Research Institute Radioisotope and Nuclear Engineering School Tokai-mura, Ibaraki-ken 319-11). *Nuclear Technology;* **59**: No. 3, 532-539(Dec 1982).

An educational laboratory experiment on radiochemistry was investigated by students in the general course of the Nuclear Engineering School of Japan Atomic Energy Research Institute. Most of them are not chemical engineers, but electrical and mechanical engineers. Therefore, the educational experiment was designed for them by introducing a "word experiment" in the initial stage and by reducing the chemical procedure as far as possible. It began with calculations on a simple solvent extraction process-the "word experiment"–followed by the chemical separation of ^{144}Pr from ^{144}Ce with tri-n-butyl phosphate in a nitric acid system and then measurement of the radioactive decay and growth of the separated ^{144}Pr and ^{144}Ce, respectively. The chemical procedure was explained by the phenomenon but not by the mechanism of chelation. Most students thought the experiment was an exercise in solvent extraction or radiochemical separation rather than a radioactive equilibrium experiment. However, a pure chemist considered it as a sort of physical experiment, where the chemical procedure was used only for preparation of measuring samples. Another experiment, where ^{137}Cs was measured after isolation with ammonium phosphomolybdate, was also investigated. The experiment eliminated the need for students who were not chemists to know how to use radioactive tracers. These students appreciated the realization that they could understand the radioactivity in the environmental samples in a chemical frame of reference even though they were not chemists.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 32659

33845 **(LBL—17220) Conditional velocity statistics in premixed CH_4-air and C_2H_4-air turbulent flames.** Cheng, R.K.; Talbot, L.; Robben, F. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 26p. (CONF-840801—14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012257.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

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Conditioned fluctuation intensities and Reynolds stress have been determined separately for the reactants and for the products in two methane-air and two ethylene-air v-shaped premixed turbulent flames. The conditioned quantities are deduced from velocity data obtained by a two-color LDA system using a conditional analysis method based on the presence of a thin flame sheet dividing the two regions. Within the turbulent flame brush, the conditioned turbulent kinetic energy in the reactants remains at the free stream level. The conditioned turbulent kinetic energy in the products, k/sub p/, are higher than in the reactants indicating flame-generated turbulence. Also, k/sub p/ increases with distance from the flame stabilizer, x. Nevertheless, the two conditioned Reynolds stresses are comparable. The unconditioned turbulent kinetic energy and Reynolds stress also increase with x. This increase is proportional to the increase in the difference between the conditioned mean velocities ΔU. The magnitude of ΔU suggests significant stream tube divergence. The results also show qualitative agreement with the model developed by Bray et al. which relates the difference in the conditioned fluctuation intensities to ΔU.

33846 **(LBL—17222) Molecular beam mass spectrometer sampling of flash ignited combustion.** Lucas, D.; Peterson, R.; Brown, N.J.; Oppenheim, A.K. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 28p. (CONF-840801—7). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006771.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

Mass signals from a transient combustion event have been measured using a molecular beam mass spectrometer with a time

resolution of approximately 100 microseconds. The signals are normalized to signals of inert components to compensate for changes in beam intensity caused by rapidly changing source conditions. Pressure traces recorded simultaneously were used to correlate mass signals to significantly reduce variations in time dependent signals caused by experimental fluctuations. Temperature measurements of the sampled gas using a time-of-flight analysis show that there are no significant perturbations caused by cell walls or the sampling orifice. The measured temperature profile is used to predict the extent of beam overrun present during various phases of the combustion event, which is necessary to determine the validity of the recorded data. Mass signals from reactants and stable products in the flash ignited combustion of methane/oxygen/nitrogen dioxide/argon mixtures are presented and discussed, and provide insight regarding the mechanism of this complex system.

33847 **(PB—84-181965) Elementary processes in the catalytic combustion of methane (mechanism, intermediates and controlling reactions). Annual report Oct 82-Sep 83.** Wise, H. (SRI International, Menlo Park, CA (USA)). Dec 1983. 42p. NTIS, PC A03/MF A01.

See also PB83-194944.

The surface reactions involved in the catalytic oxidation of methane have been investigated using single crystal metal surfaces and supported metal crystallites. Transient techniques have been used to explore the role of reaction intermediates. The decomposition of methanol and formaldehyde has been studied to identify possible surface species involved in methane oxidation.

33848 **(SAND—84-8640) Two-dimensional measurements of the [OH] in a constant volume combustion chamber.** Cattolica, R.J.; Vosen, S.R. (Sandia National Labs., Livermore, CA (USA)). Apr 1984. Contract AC04-76DR00789. 23p. (CONF-840801—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011405.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

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The planar distribution of the OH concentration in a methane-air flame in a constant volume combustion chamber has been measured with two-dimensional laser-induced fluorescence. A Nd:YAG-pumped pulsed dye laser with frequency doubling was used to form a sheet of laser light which excited the OH $A^2\Sigma$ ($v' = 1$) - X^2 Pi ($v'' = 0$) transition. The resulting fluorescence from the OH molecule in a propagating flame was observed with a low-light-level vidicon camera. A map of the OH concentration in the combustion chamber was obtained over a field of view covering 45 mm x 60 mm with a spatial resolution of 0.6 mm x 0.6 mm. For a single 5 ns laser pulse, the fluorescence signal-to-noise ratio (S/N) is 10 at the maximum OH concentration of 2.4×10^{16} cm^{-3}. The measured OH number density profile agrees with the prediction of a laminar flame model to within the experimental accuracy.

33849 **(UCRL—90251) Comprehensive chemical kinetic reaction mechanism for the oxidation of n-butane.** Pitz, W.J.; Westbrook, C.K.; Proscia, W.M.; Dryer, F.L. (Lawrence Livermore National Lab., CA (USA); Princeton Univ., NJ (USA)). 16 Jan 1984. Contract W-7405-ENG-48. 24p. (CONF-840801—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84005739.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

A detailed chemical kinetic reaction mechanism is developed for the intermediate and high temperature oxidation of n-butane. The mechanism, consisting of 238 elementary reactions among 47 chemical species, is validated by comparison between computed and experimental results from shock tubes, turbulent flow reactor, and premixed laminar flames. The model accurately reproduces n-butane combustion kinetics for wide ranges of pressure, temperature, and fuel-air equivalence ratio. In spite of the large number of species and reactions, it is found that computed results are most sensitive to reactions involving the H_2-O_2-CO submechanism, in agreement with other modeling studies of hydrocarbon oxidation.

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4201 General Engineering

REFER ALSO TO CITATION(S) 34992, 34993

33850 **(DOE/ER/13163—3) Mechanical interactions of rough surfaces. Progress report, April 1-June 30, 1984.** McCool, J.I. (SKF Industries, Inc., King of Prussia, PA (USA)). Jun 1984. Contract AC02-84ER13163. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014097.

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Mechanical interaction studies and signal processing for surface roughness parameters are reported. Rig modifications that have been implemented are reviewed along with the status of load fluctuation improvement efforts. The status of initial traction/film thickness tests which were conducted with both ball and roller test elements is reviewed. An expository paper comparing models for the contact of rough surfaces is included.

33851 **(INIS-BR—115) Stress analysis for shells with double curvature by finite element method.** Mueller, A. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). Aug 1981. 125p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780352.

A simple triangular finite element for plates and shells, is presented. Since the rotation fields are assumed independent of the displacement fields, simple shape functions of second and third degree were used. An implicit penalty method allows one to solve thin shell problems since the Kirchoff-Love hypothesis are automatically satisfied. (Author).

33852 **(NUREG/CR—3686-Vol.4) WIPS: computer code for whip and impact analysis of piping systems. Part D. Verification manual.** Powell, G.H.; Hu, F.C. (California Univ., Berkeley (USA)). Jun 1983. Contract W-7405-ENG-48. 260p. (UCRL—15597-Vol.4). NTIS, PC A12/MF A01; 1 - GPO; GPO Dep. Order Number DE84007403.

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This report presents details of a number of examples which have been chosen to verify the WIPS code. The examples have been selected to verify most (but not all) features of WIPS. For each example the following information is provided: (1) A description of the example. (2) Complete WIPSLOG file listings, detailing the steps followed in setting up the example. These listings will enable a user to reproduce each example. (3) DATA file listings. (4) Results, including comparisons with previously reported experiments and/or analyses if available. The conclusions which can be reached from the verification study are as follows. (1) WIPS is an effective tool for the analysis of restrained pipes. Nevertheless, it is recommended that additional verification examples be analyzed before WIPS is used for production analysis. (2) WIPS is an effective tool for the analysis of unrestrained pipes (with large displacements) up to impact with adjacent objects. Again, however, it is recommended that additional verification examples be analyzed before WIPS is used for production analysis. (3) WIPS appears to work well for analyses which make use of the impact analysis option but has not been tested thoroughly. These analyses are extremely complex and very expensive computationally. Considerable additional verification is recommended before production analyses are attempted.

33853 **(PNL-SA—12287) Aircraft, ships, spacecraft, nuclear plants and quality.** Patrick, M.G. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 16p. (CONF-8205268—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013262.

From American Society of Quality Control Richland Section meeting; Richland, WA, USA (17 May 1982).

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A few quality assurance programs outside the purview of the Nuclear Regulatory Commission were studied to identify features

or practices which the NRC could use to enhance its program for assuring quality in the design and construction of nuclear power plants. The programs selected were: the manufacture of large commercial transport aircraft, regulated by the Federal Aviation Administration; US Navy shipbuilding; commercial shipbuilding regulated by the Maritime Administration and the US Coast Guard; Government-owned nuclear plants under the Department of Energy; spacecraft under the National Aeronautics and Space Administration; and the construction of nuclear power plants in Canada, West Germany, France, Japan, Sweden, and the United Kingdom. (LEW)

33854 **(SAND—83-1889) Combined experimental/analytical modeling using component mode synthesis.** Martinez, D.R.; Carne, T.G.; Gregory, D.L.; Miller, A.K. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013147.

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This study evaluates the accuracy of computed modal frequencies and mode shapes obtained from a combined experimental/analytical model for a simple beam structure. The structure was divided into two subsystems and one subsystem was tested to obtain its free-free modes. Using a Component Mode Synthesis (CMS) technique, the experimental modal data base for one subsystem was directly coupled with a finite element model of the other subsystem to create an experimental/analytical model of the total structure. Both the translational and rotational elements of the residual flexibilities and mode shapes at the interface of the experimental subsystem were measured and used in the coupling. The modal frequencies and mode shapes obtained for the combined experimental/analytical model are compared to those for a reference finite element model of the entire structure. The sensitivity of the CMS model predictions to errors in the modal parameters and residual flexibilities, which are required to define a subsystem, is also examined.

33855 **(UCRL—90094) Modelling the hydrofracture process as a coupled double free boundary problem.** Stout, R.B. (Lawrence Livermore National Lab., CA (USA)). 6 Mar 1984. Contract W-7405-ENG-48. 6p. (CONF-840833—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008324.

From 5. American Society of Civil Engineers/Engineering Mechanics specialty conference; Laramie, WY, USA (1 Aug 1984).

The analysis of a propagating hydrofracture involves determining the position-time history of two free boundaries. One free boundary is the crack-tip position of the fracture and the other is for the wetted front position of fluid flowing in the fracture. A formulation of this double free boundary problem is described in terms of a rate variational principle.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 32498, 32767, 33309, 33667, 33725, 33726, 34103, 34106, 34580, 34845, 34852, 34911, 34912, 34913, 34914, 34917, 34920, 34921, 34926, 34927, 34928, 34930, 34931, 34932, 34934, 34935

33856 **(AD-A—137186/3) Far-infrared laser study of small-area superconducting tunnel junctions. Interim report.** Danchi, W.C. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Oct 1983. 224p. NTIS, PC A10/MF A01.

This document reports the first observations of photon-assisted quasiparticle tunneling and AC Josephson effect in superconducting tunnel junctions irradiated with far-infrared radiation.

33857 **(BMFT-FB-W—84-006) Optimized He II cooling systems for space application. Behaviour and handling of superfluid helium at g = 0. Phase II.** Denner, H.D.; Klipping, G.; Lueders, K.; Schotte, K.D.; Schotte, U.; Szuecs, Z.; Ruppert, U. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). Mar 1984. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751769.

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The space-technological investigations presented here aim at increasing the reliability of He II cooling systems for space applications as well as a compilation of data necessary for their optimization. He II cooling systems with operating temperatures T<=2 K and different, partly constant and partly varying cooling capacities are required for infrared astronomy as well as for other scientific investigations in space. Among the not yet fully solved problems of He II handling at zero g the separation of gas and liquid phase during the continuous evaporation of the coolant ranks first. An Active Phase Separator developed for this purpose, a system with an annular flow gap of variable length allowing variation of the cooling capacity over a wide range, has been tested on zero-g flights with KC 135, a special plane, under variation of the acceleration between 2 g and 0 g. The experimental system developed for these flight experiments with its components, which partly had to be specially developed, is described. The results of the flight experiments are presented by means of typical data and are discussed with regard to future development of the cooling systems as well as with regard to the operational demonstration of an APS in zero-g environment as required for its application in GIRL. Theoretical investigations have been made on the Choking effect which appears in case of narrow long flow gaps and which must be understood in order to ensure safe operation of He II cooling systems.

33858 **(CONF-830491—3) Optimum control of electric motor drives for industrial robots.** Guez, A.; Roberts, M. (Florida Univ., Gainesville (USA)). 1983. Contract AC05-79ER10013. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012878.

From PCI/MOTORCON 83 conference; Orlando, FL, USA (19 Apr 1983).

The industrial robot employs many actuators (electric motor drives) to perform a variety of tasks. Multilink manipulator arms, metal contouring machines, remote control tanks, and solar panels for satellites are just a few examples of applications for multiactuator systems. The first major problem is in the coupled, nonlinear structure of the interacting actuators. The second major problem is to find the optimum trajectories of motion. Determining the optimum control input for each drive is a difficult problem to solve. Due to the complex set of equations which govern the system, a great deal of simplification is necessary if a real-time computer is to be used to optimally control the motor drives. This paper describes a method for optimizing the performance (in this case, to minimize time of control) of these motorized actuators by automatically generating the input voltage signals.

33859 (DOE/ER—0113/3, pp 30-39) **Effects of low-temperature fusion neutron irradiation on critical properties of a monofilament niobium-tin superconductor.** Guinan, M.W.; Van Konynenburg, R.A.; Mitchell, J.B. (Lawrence Livermore National Lab., CA). May 1984. NTIS, PC A04/MF A01. Order Number TI84011825. Contract W-7405-ENG-48.

In Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this work was to irradiate a Nb_3Sn superconductor with 14.8 MeV neutrons at 4 K and measure critical current in transverse fields of up to 12 T, irradiating up to a fluence sufficient to decrease the critical current to below its initial value. Critical temperatures were also to be measured. The samples were to be kept near 4 K between the irradiation and the measurement of critical properties. This work is directed toward establishing an engineering design fluence limit for Nb_3Sn when used in fusion reactor superconducting magnets.

33860 **(ECN—83-203) Assembly and test of the SULTAN facility.** Franken, W.M.P. (Stichting Energieonderzoek Centrum Nederland, Petten). Dec 1983. 51p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands. Order Number TI84750916.

The development of high current, high field superconducting cables, applicable in large magnets for future fusion devices, is an important item in the European Fusion Technology Programme. In 1979 three European laboratories, SIN (Switzerland), ENEA (Italy) and ECN, started a collaboration in this field with the main objective to construct and to operate the large test facility

SULTAN (SUpra Leiter TestANlage). This facility will provide the necessary equipment for testing short samples of prototype conductors in a high bias field at various cooling modes and operation conditions. The SULTAN facility will be constructed in two phases. The first phase involved the construction of superconducting background coils for 8 Tesla field in a one meter cold bore and all indispensable equipment on cryogenics, power supplies and data acquisition for magnet operation and conductor testing. In the second phase the coil system will be upgraded to 12 Tesla in a 0.6 m bore by A-15 insert coils. The fabrication of the various components for the first construction phase has been finished early 1983. The facility was then assembled at SIN in Villigen, Switzerland and put into operation successfully. The operation experience is summarized for the first cooldown and energization with special attention to the 8 Tesla insert coil, that was delivered by ECN as their contribution to the SULTAN collaboration.

33861 **(GA-A—17545) Improved method for the prediction of centrifugal compressor rotational-tone noise.** Adams, R.G.; Vickers, B.H. (GA Technologies, Inc., San Diego, CA (USA)). Apr 1984. Contract AT03-84SF11963. 9p. (CONF-840804—22). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013345.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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This paper presents a method of calculating the sound power produced by the action of the impeller vanes from the design parameters of the compressor and the calculated flow loss coefficients. This method develops relationships between the non-dimensional wake width, ratio between the jet and wake velocities and the impeller loss coefficient. Fourier analysis of the resulting square wave gives an expression for the fluctuating pressure force at the impeller exit surface. This is then applied to the acoustic dipole source term derived in an earlier paper to calculate the sound power produced by the rotating impeller.

33862 **(INIS-mf—8395) Description of the transport/storage container TN 1300.** Anspach, W. (Transnuklear G.m.b.H., Hanau (Germany, F.R.)). Oct 1980. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780254.

TN 8015 A.

The container TN 1300 developed by Transnuklear GmbH at Hanau served for dry transport and for storage of irradiated fuel assemblies from light water reactors of the type 1300 MWe. The container belongs to the packing category of the type B(U) and to the nuclear safety class II. (orig./RW).

33863 (INIS-SU—219, pp 152-158) **Cool-down of circulation-type superconducting magnetic systems.** Gorbachev, S.P.; Krikunov, A.A.; Ladokhin, S.D. (Nauchno-Proizvodstvennoe Ob"edinenie Kriogennogo Mashinostroeniya, Balashikha (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8206209—Vol.2).

From EPRI symposium on the state of the art of power plant feed pumps; Cherry Hill, NJ, USA (2 Jun 1982).

Cool-down of two channels of superconducting systems with cryoagent once-through flow is considered analytically. Heat exchange between channels through "heat bridges" (electric insulation spacers, etc) in case of stepwise changes of the inlet gas temperature is considered. The model proposed and analytical dependences obtained can be used for calculating the cool-down time for superconducting magnetic systems. Determining the cool-down time is shown to be feasible for complex multichannel objects with different boundary conditions by reducing the object to one channel in a definite thermal resistance range.

33864 **(K/CSD/TM—52) Ekman boundary conditions for numerical models of centrifuge flows.** Park, J.E.; Drake, J.B. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Apr 1984. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013576.

The boundary layers which form on the ends of a gas centrifuge have received a great deal of analytical attention from individuals concerned with predicting flows within gas centrifuges. Three basic approaches have been taken in estimating the heat transfer and drag at the solid gas interfaces at the ends of a centrifuge. First, the details of the flow may be estimated numerically using finite difference techniques and a very fine grid in the vicinity of the ends. The approach yields an enormous amount of detail. The cost in computer time and memory charges is very great and the extensive detail is difficult to utilize effectively. Second, the boundary layers may simply be ignored. With this approach, the size of the finite difference mesh is controlled by other considerations, allowing economically attractive simulation of centrifuge flows for many situations. Mathematically, the boundary conditions in the second option are simply zero shears rather than specified velocities, zero heat fluxes rather than specified temperatures. However, complete neglect of boundary layer influence at the ends is disquieting from a physical viewpoint. The third effort has been to model the boundary layers analytically and couple those models to solutions for the interior flow. In this chapter, previous efforts to model the boundary layers are reviewed.

33865 **(N—8418575) Modeling of transient heat pipe operation.** Colwell, G.T.; Hartley, J.G. (Georgia Inst. of Tech., Atlanta (USA)). Feb 1983. 11p. (NASA-CR—173305). NTIS, PC A02/MF A01.

The major goal of this project is to develop mathematical models of heat pipes which can be used to predict transient behavior under normal and adverse conditions. The models and solution techniques are to be formulated so that they can be incorporated into existing NASA structural design codes. The major parameters of interest are heat flux distribution, temperature distribution, working fluid pressure distribution, fluid and containment thermal and mechanical properties and geometry. Normal transient operation is taken to be operating conditions where the capillary structure remains fully wetted. Adverse transient operation occurs when drying, re-wetting, choking, non-continuum flow, thawing, freezing, etc., occur in the internal heat pipe working fluid.

33866 **(SAND—84-0485C) Effect of thermal aging on the output of a pyrotechnic actuator.** Rogers, J.W. Jr.; Erickson, K.L.; Bickes, R.W. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC02-76CH00016. 13p. (CONF-840867—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012903.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

A thermal aging program with a shock-initiated through-bulkhead actuator (TBA) indicates an enhancement of energy output with age and storage temperature. The TBA and output experiments are described and a possible mechanism that accounts for this phenomenon is presented.

33867 **(SAND—84-0972) Optical fiber termination and splicing techniques.** George, M.; Miller, M.M. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013919.

This report details various techniques that have been developed during the course of optical fiber experimentation and installations. During the development phases, attempts have been made to devise the quickest and least tedious methods in each area of optical fiber work. These procedures include the termination and splicing of various cable types. Also included are appendices containing information on tools, connectors, jumpers, and splicing equipment.

33868 **(SAND—84-1297C) Failure prediction of notched pressure vessels using the CTOD approach.** Wellman, G.W.; Rolfe, S.T.; Dodds, R.H. (Sandia National Labs., Albuquerque, NM (USA); Kansas Univ., Lawrence (USA). Dept. of Civil Engineering). 1984. Contract AC04-76DP00789. 11p. (CONF-840647—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013057.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

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Currently accepted analysis procedures to determine failure pressures of notched vessels are limited to the types of behavior defined by Linear Elastic Fracture mechanics (LEFM) or by various

types of limit load calculations. LEFM is restricted to very brittle material behavior (linear elastic plane-strain behavior, K/sub Ic/, as defined by ASTM E-399). Limit load calculations generally are restricted to upper shelf, flow stress dependent material behavior. There is a wide range of material behavior between these two types of analysis where Elastic-Plastic Fracture Mechanics (E-PFM) analysis should be used. This paper discusses the application of the Crack Tip Opening Displacement (CTOD) elastic-plastic fracture parameter to predict burst pressures. A series of burst tests performed on notched pressure vessels was analyzed. The tested vessels exhibited behavior ranging from very brittle to entirely ductile. The current British Welding Institute (Burdekin-Dawes design curve) approach as well as the finite element method was used to obtain the analytical burst pressures for each vessel. Nonlinear finite element computations were performed on both 2-D and 3-D models of the notched vessels. Predictions of burst pressure obtained using the British Welding Institute design approach (which is to insure fail-safe behavior and thus has a built in factor of safety) and the finite analysis element method are compared with the actual experimental burst pressures. Burst pressures computed using nonlinear finite element analyses agree to within seven percent of experimental burst pressures in each case. The predicted burst pressures based on finite element computations are significantly more accurate than those predicted using the current British Welding Institute approach.

33869 **(UCRL—90475) Design of a high-performance slide and drive system for a small precision machining research lathe.** Donaldson, R.R.; Maddux, A.S. (Lawrence Livermore National Lab., CA (USA)). Mar 1984. Contract W-7405-ENG-48. 21p. (CONF-840850—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84011059.

From CIRP assembly; Madison, WI, USA (20 Aug 1984).

The development of high-accuracy machine tools, principally through interest in diamond turning, plus the availability of new cutting tool materials, offers the possibility of improving workpiece accuracy for a much larger variety of materials than that addressed by diamond tools. This paper describes the design and measured performance of a slideway and servo-drive system for a small lathe intended as a tool for research on the above subject, with emphasis on the servo-control design. The slide system provides high accuracy and stiffness over a travel of 100 mm, utilizing oil hydrostatic bearings and a capstan roller drive with integral dc motor and tachometer.

33870 **Quench back in thin superconducting solenoid magnets.** Green, M.A. (Lawrence Berkeley Lab., CA (USA)). *Cryogenics;* **24**: No. 1, 3-10(Jan 1984).

The paper develops the theory for thermal quench back in thin solenoid magnets and compares the theory with measurements made in two one-meter diameter superconducting solenoid magnets.

33871 **Free electron laser for a mildly relativistic electron beam.** Uhm, H.S. (Naval Surface Weapons Center Silver Spring, Maryland 20910). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3121-3123(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

One of the most basic instabilities which characterize a relativistic electron beam propagating through a helical wiggler (or undulator) magnetic field is the free electron laser instability. This instability has been extensively investigated in recent years with particular emphasis on applications involving high power microwave radiation. Previous theoretical studies of this instability have tended to result in the conclusion that high energy beams with a relativistic factor much greater than 1 are required to generate high frequency microwave radiation. Beams with this high a relativistic factor have proven to be highly unsuited, however, to compact and practical microwave tubes. To this end, for a relativistic electron beam propagating through a dielectric loaded waveguide, this paper presents a method for the bandwidth and frequency enhancement of the free electron laser instability which makes use of a mild (less than 1.5) relativistic factor. It demonstrates that the instability bandwidth and frequency can be greatly enhanced for specified values of the beam energy and wiggler wavelength if the dielectric constant and the thickness of the dielectric material are appropriately selected. The paper also presents a new scheme for a broad bandwidth microwave amplifier.

33872 **Compulsator, a high power compensated pulsed alternator.** Weldon, W.F.; Bird, W.L.; Driga, M.D.; Rylander, H.G.; Tolk, K.M.; Woodson, H.H. (Center for Electromechanics, Univ. of Texas at Austin, Austin, TX 78712). pp 925-938 of Energy storage, compression, and switching. Vol. 2. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—). Contract W-7405-ENG-48.

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter describes a pulsed power supply utilizing inertial energy storage as a possible replacement for large capacitor banks. The compulsator overcomes many of the limitations of the pulsed homopolar generators previously developed by the Center for Electromechanics and elsewhere in that it offers high voltage (10's of kV) and consequently higher pulse rise times, is self commutating, and offers the possibility of generating repetitive pulses. The compulsator converts rotational inertial energy directly into electrical energy utilizing the principles of both magnetic induction and flux compression. The theory of operation, a prototype compulsator design, and advanced compulsator designs are discussed.

4203 Lasers

REFER ALSO TO CITATION(S) 33871, 34006

33873 **(AD-A—137317/4) New high power coherent radiation sources. Memorandum report.** Sprangle, P.; Coffey, T. (Naval Research Lab., Washington, DC (USA)). 9 Jan 1984. 48p. (NRL-MR—5224). NTIS, PC A03/MF A01.

In recent years, there has been considerable renewed interest in the development of novel devices for the production of high power coherent electromagnetic radiation. This interest has been motivated largely by the realization that, with existing technology, certain processes utilizing relativistic electron beams can produce coherent electromagnetic radiation at power levels far in excess of those achieved by conventional electron devices. This paper will review the current status of this rapidly developing field, with emphasis on two generic devices. The major thrust in the recent development of electron beam driven radiation sources has been directed towards achieving shorter wavelengths, greater power and higher efficiencies. Shortly after the development of such successful sources as the magnetron, kylstron and various traveling wave devices, it became clear that, in their original form, they were limited in their ability to produce high levels of radiation efficiently at short wavelengths. To circumvent the inherent limitations of these conventional coherent radiation sources, many new concepts and mechanisms, as well as variations on conventional concepts, were proposed. This paper is concerned primarily with two devices which are, relatively speaking, newcomers to the list of coherent classical radiation sources. They are the free electron laser and the cyclotron resonance maser (CRM); one well known type of CRM is the gyrotron.

33874 **(INIS-BR—107, pp 41-42) Grazing-incidence dye laser with an intra-cavity.** Lisboa, J.A.; Teixeira, S.R.; Cunha, S.L.S.; Francke, R.E. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Grieneisen, H.-P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Laboratorio de Estudos Avancados). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33875 (INIS-BR—107, pp 91-92) **Collective effects on the operation of free-electron lasers with an axial guide field.** Freund, H.P.; Sprangle, P. (Naval Research Lab., Washington, DC (USA)); Dillenburg, D.; Jornada, E.H. da; Schneider, R.S.; Liberman, B. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

33876 **(K/ET—235) Discharge pumped rare gas halide laser materials and gas clean-up studies.** Akerman, M.A.; Tennant, R.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Los Alamos Scientific Lab., NM (USA)). Sep 1979. Contract AC05-84OT21400. 19p. (CONF-7909277—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012756.

From Excimer laser meeting; Charleston, SC, USA (11 Sep 1979).

Rare Gas Halide (RGH) laser systems were subjected to corrosion tests with F_2. The resultant impurties (HF, CO_2, COF_2, SO_2F_2, SiF_4, C_2F_6, CF_4, and C/sub x/H/sub x/) decreased laser operation and energy output to varying degrees, up to and including shutdown. Trapping systems were developed to remove the impurities and return the laser to higher operation efficiencies. The most effective systems were LN_2 for ArF lasers and hot calcium operating at 600° to 700°C for KrF and XeCl lasers.

33877 **(N—8418622) Development of X-ray laser media. Measurement of gain and development of cavity resonators for wavelengths near 130 angstroms, Volume 2.** Forsyth, J.M. (Rochester Univ., NY (USA)). Feb 1983. 217p. (AD-A—136306). NTIS, PC A10/MF A01.

The characteristic properties of multilayer reflectors for X-ray and XUV radiation (1A - 600A) permit solutions to Maxwell's equations for a quasi-periodic reflector whose layers may contain arbitrary index gradients. This solution can be formulated as a difference equation that propagates the amplitude reflectance across each layer pair. The difference equation resembles the Airy summation for single layers, but has a simpler Ricatti form. From the difference equation, design criteria can be derived for maximization of multilayer reflectivity. These criteria provide guidance in the selection of appropriate multilayer materials, and are used to derive approximate scaling laws for multilayer reflecting properties. The reflecting properties of X-ray multilayer devices are discussed.

33878 **(PB—84-147230) Argument principle in stability analysis: application to a single-mode laser with optical feedback.** Jaskorzynska, B.; Lenstra, D. (Technische Hogeschool Delft (Netherlands). Afdeling Elektrotechniek). Oct 1983. 26p. NTIS, PC E04/MF E01.

The argument principle is employed to numerically investigate the stability of simple-harmonic solutions to a non-linear ordinary difference-differential equation. This equation is an extension of a similar one used earlier to analyse the properties of the field in a laser with external feedback. The present extension includes multiple reflections in the external system.

33879 **Free electron lasers for laser fusions.** Segall, S. (KMS Fusion, Inc., Ann Arbor, MI 48106). pp 201-218 of Energy storage, compression, and switching. Vol. 2. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—). Contract AC08-78DP40030.

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter describes a design for a pulsed multipass free electron laser (FEL) employing a recirculating electron beam. The FEL has many potential advantages as a laser fusion driver including tuneability, high repetition rate, and potential high efficiency. An output power of 100 TW can be obtained with an optical system consisting of only 4 amplifiers and 4 mirrors with a peak electron current in the storage ring of 1600 amperes. Laser efficiencies of up to 50% may be possible. Methods are discussed of compensating or correcting for induced electron energy spread, and a technique is explained for reducing peak input power requirements in a reactor-sized system.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 33087, 33268, 33345, 33346, 33615, 33857, 33860

33880 **(BNL—34707) Two-fluid instability.** Stewart, H.B. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 8p. (CONF-840816—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012899.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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The ability of interpenetrating flow models to represent multidimensional instabilities is probed by numerical experiments with an L-shaped two-fluid jet. Periodic and nonperiodic oscillations of various types are observed, and a partial phase portrait is constructed. The numerical experiments suggest new approaches to verifying transient interpenetrating flow models. 18 references.

33881 **(CONF-831063—14) Effects of system and geometrical parameters on the flow of Class-B solids in overflow standpipes.** Sauer, R.A.; Chan, I.H.; Knowlton, T.M. (Institute of Gas Technology, Chicago, IL (USA)). 1983. Contract AC21-80ET14705. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013948.

From American Institute of Chemical Engineers fall annual meeting; Washington, DC, USA (30 Oct 1983).

This seal-leg study was initiated to provide information on the flow characteristics of Class B solids through standpipes. Experiments were conducted to determine the effects of solids flow rate, particle density, particle size, standpipe diameter, fluidizing-gas velocity, standpipe pressure drop and standpipe exit height on the performance of standpipes operating in the overflow mode. The effects of the amount and location of standpipe aeration and the effect of standpipe angle of inclination were also investigated.

33882 **(CONF-840816—4) Heat transfer with phase change in plate-fin heat exchangers.** Panchal, C.B. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006405.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

A theoretical and experimental study was conducted for convective evaporation and condensation in plate-fin compact heat exchangers. The overall performance of a brazed-aluminum heat exchanger in the evaporation mode with ammonia and in the condensation mode with both ammonia and refrigerant R-22 as working fluids. The heat exchanger has straight perforated fins on the working-fluid side and extruded rectangular channels on the single-phase (water) side. The two-phase flow in narrow channels of the heat exchanger is modeled using a triangular relationship between pressure gradient, liquid film flow rate, and film thickness. The overall performance of the heat exchanger is calculated by employing local heat-transfer analysis and integrating mass- and heat-balance equations along the heat-exchanger length. Theoretical predictions are found to agree favorably with experimental results for a prototypical heat exchanger unit.

33883 **(CONF-840816—5) Shellside waterflow pressure drop distribution measurements in an industrial-sized test heat exchanger.** Halle, H.; Chenoweth, J.M.; Wambsganss, M.W. (Argonne National Lab., IL (USA); Heat Transfer Research, Inc., Alhambra, CA (USA)). 1984. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006412.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

Throughout the life of a heat exchanger, a significant part of the operating cost arises from pumping the heat transfer fluids through and past the tubes. The pumping power requirement is continuous and depends directly upon the magnitude of the pressure losses. Thus, in order to select an optimum heat exchanger design, it is as important to be able to predict pressure drop accurately as it is to predict heat transfer. This paper presents experi-

mental measurements of the shellside pressure drop for 25 different segmentally-baffled bundle configurations in a 0.6-m (24-in.) diameter by 3.7-m (12-ft) long shell with single inlet and outlet nozzles. Both plain and finned tubes, nominally 19-mm (0.75-in.) outside diameter, were arranged on equilateral triangular, square, rotated triangular, and rotated square tubefield layouts with a tube pitch-to-diameter ratio of 1.25. Isothermal water tests for a range of Reynolds numbers from 7000 to 100,000 were run to measure overall as well as incremental pressure drops across sections of the exchanger. The experimental results are given and correlated with a pressure drop versus flowrate relationship. A preliminary method was developed to predict shellside nozzle pressure drop.

33884 **(CONF-841201—10) Experimental study of natural convection melting of ice in salt solutions.** Fang, L.J.; Cheung, F.B.; Linehan, J.H.; Pedersen, D.R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013455.

From ASME winter annual meeting; New Orleans, LA, USA (9 Dec 1984).

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The solid-liquid interface morphology and the micro-physical process near the moving phase boundary during natural convection melting of a horizontal layer of ice by an overlying pool of salt solution were studied experimentally. A cathetometer which amplifies the interface region was used to measure the ice melting rate. Also measured were the temperature transients of the liquid pool. Within the temperature and the density ratio ranges explored, the ice melting rate was found to be very sensitive to the ratio of pool-to-ice melt density but independent of pool-to-ice temperature difference. By varying the density ratio, three different flow regimes and morphologies of the solid-liquid interface were observed, with melt streamers emanating from the crests of the wavy interface into the pool in all three cases. The measured wavelengths (spacing) between the streamers for four different pairs of materials were correlated with the density ratio and found to agree favorably with the predictions of Taylor instability theory.

33885 **(CTOM—46983) Study of air-water two-phase flow using the neutron attenuation technique.** Younis, M.H. (McMaster Univ., Hamilton, Ontario (Canada)). Oct 1979. 402p. Canadian Theses on Microfiche Service, National Library of Canada, Ottawa K1A 0N4.

Void behaviour in a vertical conduit containing a flowing mixture of air was studied using a neutron attenuation technique. A neutron beam extracted from McMaster's Swimming Pool Reactor was conditioned to provide a collimated beam of thermal neutrons with low gamma and fast neutron background. A series of experiments was performed to obtain information on the steady-state radial void profile in the bubble and annular flow regimes for a 3/4 in. I.D. test section with gas and liquid fluxes up to about 32 m/sec and 80 cm/sec respectively. The dynamic behaviour of the system to a perturbation in gas flowrate was measured and compared to that predicted by the void propagation equation.

33886 **(INIS-BR—116) Numerical calculation of the main variables of the laminar flow around a circumferential square obstacle at the wall of a circular pipe.** Nogueira, A.C.R. (Santa Catarina Univ., Florianopolis (Brazil). Programa de Pos-graduacao em Engenharia Mecanica). Oct 1981. 128p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780350.

The numerical calculation of the main variables of the laminar, incompressible, axissymmetric, steady flow around a circumferential square obstacle placed at the wall of a circular pipe, is done. The velocity profiles, the separating length and the shape of the separating streamline are compared with experimental available data and a good agreement is achieved. (E.G.).

33887 (INIS-BR—119, pp 14) **Solution of the heat conduction equation.** Santos, R.S. dos; Alvim, A.C.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33888 (INIS-BR—119, pp 163) **Determination of inlet temperature of CTS-1 heater, under critical conditions of outlet temperature and rate of flow.** Araujo, F.G.B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33889 (INIS-BR—119, pp 164-165) **Natural convection in sodium thermal circuit.** Walsh, L.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33890 (INIS-BR—119, pp 165-166) **Temperature measurement of fusion range of sodium stored in drain tank.** Nagy, G.P. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33891 (INIS-BR—119, pp 168) **Experimental studies on the velocity of a particle immersed in a rotating fluid.** Cesar, S.B.G. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33892 (INIS-BR—119, pp 162) **Modifications in the CTS-1 sodium thermal loop.** Bellini, I.W.; Costa, A.M.P. da; Silva Porto, F.G. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33893 (INIS-BR—119, pp 163) **Calculation of a thermal field in the heater cover of CTS-1 sodium loop.** Araujo, F.G.B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33894 (INIS-BR—119, pp 164) **Project of a cold trap for CTS-1 sodium thermal loop.** Araujo, F.G.B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33895 (INIS-BR—119, pp 164) **Project of the new sustenance springs for CTS-1 pipelines.** Nagy, G.P. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33896 (INIS-BR—119, pp 166) **Testing of bearing spring of CTS-1 plugging-meter.** Nagy, G.P. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33897 (INIS-BR—119, pp 168-169) **Installation and operation of water loop. Loop installation.** Moeller, S.V.; Castro Moreira, L.Q. de; Bellini, I.W.; Croza, G.I.; Ferreira, D.A.; Bispo, D.A.; Araujo Saraiva, I. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33898 (INIS-BR—119, pp 169) **Installation and operation of water loop. Loop operation.** Moeller, S.V.; Castro Moreira, L.Q. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33899 (INIS-BR—119, pp 169-170) **Evaluation of heat exchanger performance.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33900 (INIS-BR—119, pp 172) **Stress analysis in a sodium loop at IEN (Institute of Nuclear Engineering).** Correia Filho, A.; Jesus Miranda, C.A. de; Bezerra, L.M.; Brito Aghina, L.O. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33901 (INIS-BR—119, pp 172) **Stress analysis in the pipeline of the loop plugging-meter.** Correia Filho, A.; Jesus Miranda, C.A. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

33902 (INIS-mf—8903, pp 119-120b) **Development of a heavy water thermodynamic and transport property package for thermal-hydraulic transient analysis codes.** Wacholder, E.; Kaizerman, S.; Tomerian, N. (Technion-Israel Inst. of Tech., Haifa. Dept. of Nuclear Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33903 (INIS-mf—8903, pp 121-123) **Hydrodynamic effects of the gap between the fuel rod longitudinal fins and the tube.** Emrani, S.; Naot, D. (Technion-Israel Inst. of Tech., Haifa. Dept. of Nuclear Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

33904 **(KFK—3641) Pattern selection in single-component systems coupling Benard convection and solidification.** Davis, S.H.; Mueller, U.; Dietsche, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Dec 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751442.

A horizontal layer is heated from below and cooled from above so that the enclosed single-component liquid is frozen in the upper part of the layer. When the imposed temperature difference is such that the Rayleigh number across the liquid is supercritical, there is Benard convection coupled with the dynamics of the solidification interface. An experiment is presented which shows that the interfacial corrugations that result are two-dimensional when this "ice" is thin but hexagonal when the "ice" is thick. A weakly-nonlinear convective instability theory is presented which explains this behavior, and isolates the mechanism of the pattern selection. Jump behavior is seen in the liquid-layer thickness at the onset of hexagonal convection.

33905 **(LA-UR—84-166) Temperature and heat-flux distributions in a strip-heated composite slab.** Jones, G.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 19p. (CONF-840816—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006016.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

The steady temperature and heat-flux distributions for a composite slab consistig of a strip-heated, large-conductivity fin in intimate contact with a small-conductivity, convectively cooled substrate are obtained. Such a problem has application to the strip heating of process equipment and laboratory experiments where uniform thermal conditions are desired and where the conductivity of the substrate is small. Analytical methods are used to obtain closed-form solutions for the local temperature and heat flux for the full, two-dimensional problem and for the bounding case of no transverse conduction within the substrate. A design procedure to determine the strip-heater spacing necessary for a prescribed maximum variation in heat flux at he convectively cooled surface is presented. An application example is given and the results discussed. Expressions for the steady temperature and heat flux are also obtained for the limiting cases of infinite heat transfer coefficient and zero-thickness substrate.

33906 **(LA-UR—84-1189) Investigation of single-substance horizontal two-phase flow.** Dickinson, D.A.; Maeder, P.F. (Brown Univ., Providence, RI (USA). Div. of Engineering; Los Alamos National Lab., NM (USA)). Mar 1984. Contract AC02-79ET27225. 186p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84012292.

Portions are illegible in microfiche products; Thesis. Submitted by D.A. Dickinson.

Despite the abundance of work in the field of two-phase flow, it seems as though a consensus has not been reached on some of the fundamental points. Although exceptions exist, adequate physical interpretation of the flow seems to be hindered either by complexity of analysis or, in the opposite extreme, the trend toward limited-range analysis and correlations. The dissertation presents the derivation of basic conservation equations for the phases. The combined equations are used to examine the phenomenon of slip and its practical limitations, the Fanno line for single-substance flow and the effect of slip on choking. Equations for critical mass flux in the presence of slip are derived. The Mach, Reynolds and Froude numbers based on conditions at flashing are introduced as the characteristic parameters, and the importance of compressibility in single-substance two-phase flow is discussed. Experimental measurements of pressure change and void fraction for flow in the highly compressible range ($.5 < Ma < 1$) are presented. The working fluid is Refrigerant R-114, at room temperature, in a test section of diameter 5 cm and length 8 m. The effect of the Froude and Mach numbers is examined. The experimental facility is operated intermittently with running times of approximately two minutes and is instrumented for rapid measurements using a computer data acquisition and control system. A description of the facility and procedure is provided.

33907 **(LA-UR—84-1704) Heat pipe development status.** Merrigan, M.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 10p. (CONF-8406131—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012580.

From 1. SP-100 program integration meeting; Danvers, MA, USA (13 Jun 1984).

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Test heat pipes have been operated in the 1400 K to 1700 K range for periods in excess of 20,000 hours with the objective of understanding and controlling corrosion and failure mechanisms. The results of a post test analysis of one of these heat pipes that was operated for 25,216 hours at 1700 K are reviewed and the implications for heat pipe lifetime discussed. An in-process report of an investigation of transient heat pipe behavior is presented. This investigation is being conducted as a result of restart problems encountered during life test of a 2 m. radiation cooled heat pipe. The results of a series of shut-down tests from power and temperature are given and probable causes of the restart problem discussed.

33908 **(SAND—83-2358C) Least-squares smoothing of direct-exchange areas in zonal analysis.** Larsen, M.E.; Howell, J.R. (Sandia National Labs., Albuquerque, NM (USA); Texas Univ., Austin (USA). Dept. of Mechanical Engineering). 1984. Contract AC04-76DP00789. 17p. (CONF-840816—1). NTIS PC A02/MF A01. Order Number DE84002612.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

The method of Lagrange-multipliers has been used to determine adjustments to be made to a set of direct-exchange areas used in zonal analysis of a radiating enclosure containing a participating medium. The resulting adjusted direct-exchange areas satisfy conservation laws and the condition that an objective function be minimized. The objective function allows weights to be assigned to each adjustment. The solution of a set of linear algebraic equations yields the required adjustments. The method is well-suited for adjusting a set of direct-exchange areas which are assumed to include random inaccuracies. Other adjustment techniques in the literature are discussed and compared, and application of the present method is demonstrated.

33909 **(UCRL—90319) Unsteady heat transfer during laminar flame quenching.** Vosen, S.R.; Greif, R.; Westbrook, C. (Lawrence Berkeley Lab., CA (USA); Lawrence Livermore National Lab., CA (USA)). 23 Jan 1984. Contract W-7405-ENG-48;AC03-76SF00098. 23p. (CONF-840801—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006301.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

Measurements were made of the unsteady heat transfer to a wall during the quenching of premixed, methane-air flames. One dimensional laminar flames were produced in a constant volume chamber and the heat transfer into the quenching surface was measured by means of a platinum thin film resistance thermometer. The experiments were performed at pressures near atmospheric over a range of equivalence ratios from 0.7 to 1.2. Predictions of the heat transfer were made with two numerical finite difference models, one with detailed kinetics and the other with single step kinetics. The main experimental results are: (1) the data are successfully correlated using the heat release rate of the flame prior to quenching; and (2) the maximum heat flux is related to the quenching distance and thus it may be possible to use measurements of the quenching distance to predict the maximum heat flux. A comparison of the experimental results and the numerical calculations revealed that: (1) a single step reaction model predicts the heat transfer as well as a detailed kinetics model, to within 15% of the experimental results; and (2) thermal diffusion and the chemical reaction rate of combustion are the dominant processes which determine the heat flux during quenching.

33910 **Comments on the formulation of the one-dimensional six-equation two-phase flow model.** Le Cog, G.; Lewi, J.; Raymond, P. (Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Saclay Service d'Etudes de Reacteurs et de Mathematiques Appliquees, Boite Postale No. 2 91190 Gif-sur-Yvette). *Nuclear Science and Engineering;* **81**: No. 1, 1-8(May 1982).

The use of the one-dimensional two-phase flow six-equation model requires knowledge of mass, momentum, and energy transfers between the phases. These transfers can be expressed from the flow parameters and their derivatives. The first part of this paper is devoted to the formulation of the entropy production at the interface as a function of the velocity, Gibbs potential and temperature of each phase. It is assumed that each transfer can be expressed in the form $R = R^* + \delta R$, where R^* is the reversible part and δR the irreversible part of the transfer R. The linear theory of irreversible thermodynamics allows the formulation of δR. The expression of R^* may include differential terms. In the second part of this paper, the authors show how to write interfacial transfer terms to reduce the six-equation model into a lower order model. The last part of this paper presents an original method for computing critical flow, taking into account the flow blockage phenomenon, which is observed when variations of downstream conditions do not produce any significant effect on the upstream flow, even though the fluid velocity is less than the sound velocity.

33911 **A numerical study of weakly compressible rotating flows in a gas centrifuge.** Harada, I. (Energy Research Laboratory, Hitachi, Ltd. 1168 Moriyama-cho, Hitachi, Ibaraki 316). *Nuclear Science and Engineering;* **73**: No. 3, 225-241(Mar 1980).

Numerical investigations have been made on thermally, mechanically, and thermomechanically driven flows of a weakly compressible gas in a gas centrifuge assuming an axisymmetric continuum flow. The finite difference method developed for these computations is based on the Euler/upwind scheme and provides a numerically stable solution. It is found that an almost cylindrical Couette flow is established in an annulus despite the end effects of the plates and that the two mechanically driven circulations interact with the thermally driven circulations.

4205 Materials Testing

REFER ALSO TO CITATION(S) 33068, 33152, 33868

33912 **(EGG-M—11584) Enhanced fourier algorithms for ultrasonic crack characterization.** Seydel, J.A.; Johnson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 6p. (CONF-8404123—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012544.

From 2. symposium on energy engineering sciences; Argonne, IL, USA (10 Apr 1984).

This paper describes the detection and processing of information in ultrasonic data that is usually ignored in the imaging process. Experimental evidence shows that such data carries information concerning the target size; simulations and experimental data demonstrate a new data processing method which can substantially increase the sensitivity of ultrasonic image forming systems.

33913 **(EPRI-NP—3347-SR) Nondestructive evaluation program: progress in 1983.** Dau, G.J.; Armor, A.; Kolar, M.J.; Lapides, M.E.; Liu, S.N.; Oldberg, T.; Quinn, J.R.; Scheibel, J.R.; Viswanathan, R. (Electric Power Research Inst., Palo Alto, CA (USA). Systems and Materials Dept.). Mar 1984. 564p. (CONF-8311171—). Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920314.

From EPRI nondestructive examination information meeting; Palo Alto, CA, USA (10 Nov 1983).

The increasing cost of equipment for generating plants and the potential increase in productivity and safety available for rapidly-developing Nondestructive Evaluation (NDE) technology led EPRI to the initiation of a Nondestructive Evaluation Program in 1974. The major direction to date has been toward light water reactor inspection problems; however, increased application to other systems is now underway. This report presents a comprehensive review of the EPRI effort in this area. Most of the report consists of contractor-supplied progress reports of each current project. An organizational plan of the program is presented in overview. Organization from several viewpoints is presented, e.g., in-service inspection operations, R & D personnel, and utility representatives. The progress reports are arranged into sections titled: general, pipe and nozzle, pressure vessel, steam generator and boiler tube, turbine, and materials properties measurements. Separate abstracts have been prepared for 24 of the progress reports. (DLC)

33914 (INIS-BR—120, pp 115-116) **Technique for radiographic test of pipe/plug welded joints for nuclear reactor fuel rods.** Ramos, C.W.; Gante, V.; Ribeiro, L.M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

33915 **(IS-M—488) Application of elastic wave scattering theory to the detection and characterization of flaws in structural materials.** Thompson, R.B. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 14p. (CONF-840647—20). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013729.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

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The uses of elastic wave scattering theory in ultrasonic nondestructive evaluation are reviewed. The present understanding of the scattering from stress free, elliptical cracks in unbounded media is first summarized. This is followed by a discussion of additional

problems imposed by the topography of real cracks and part surfaces. Finally, the increasing use of models in engineering applications is illustrated by examples taken from the inspection of nuclear power plant piping and pressure vessel welds and aircraft turbine engine rotor components.

4206 Safety Engineering

REFER ALSO TO CITATION(S) 33936

4207 Vacuum Engineering

33916 **(DOE/ER/10709—3) Method of vibrational control in the problem of stabilization of chemical reactors. Final report, July 1, 1980-February 29, 1984.** Meerkov, S.M. (Illinois Inst. of Tech., Chicago (USA)). May 1984. Contract AC02-80ER10709. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013451.

The main objective of this research project was to further develop a new control technique, referred to as Vibrational Control, and apply it to stabilization of unstable, but economically efficient, steady states of Chemical Reactors. This objective has been achieved. A method for analysis of dynamic systems with fast parametric oscillations has been developed. Conditions of vibrational stabilizability for a class of nonlinear systems have been derived. The developed formalisms have been applied to the problem of vibrational stabilization of exothermic, catalytic and autocatalytic reactions taking place in Continuous Stirred Tank Reactors. It has been shown that the introduction of vibrational control results in an increase of the reactor yield in the range of 20% to 300%, depending on the reactor conditions and operating point.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 34125

33917 **(BMFT-FB-T—84-010) Dyes for displays.** Claussen, U. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jan 1984. 30p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751278.

The objective of the project was the improvement of contrast and visibility of LCD by two different means: - by development of fluorescent dyes to increase the visibility of fluorescent activated displays (FLAD); - by development of dichroic dyes to increase the contrast of displays. This work has been done in close cooperation with the electronic industry, where the newly synthesized dyes were tested. The targets for the chemical synthesis were selected with the help of computer model calculations. Results: The work on FLAD resulted in a marketable range of dyes. Since the interest of the electronic industries concerning FLAD was low, the investigations were stopped. Dichroic dyes, especially black mixtures with good light fastness, order parameter, and solubility in nematic phases have been developed. The application of these dyes is restricted to in-door use only because of an increase of viscosity below -10°C. Applications on a technical scale, e.g. for the automotive industry, will only the possible if the displays work at temperatures down to -40°C. This problem requires a complex optimization of the dye/nematic phase system.

33918 **(LA—8862-MS-Rev.2) Magnetic switches and circuits. Rev. 2.** Nunnally, W.C. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014141.

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This report outlines the use of saturable inductors as switches in lumped-element, magnetic-pulse compression circuits. The operation of the three basic types of magnetic pulse compression circuits is discussed and the characteristic use of each is defined. In addition, the geometric constraints and magnetic pulse compression circuits used in short-pulse, low-inductance systems are considered. The scaling of presaturation leakage currents, magnetic energy losses, and switching times with geometrical and material parameters are developed to aid in evaluating magnetic pulse compression systems in a particular application. Finally, a scheme for increasing the coupling coefficient in saturable stripline transformers is proposed to enable their use in the short-pulse, high-voltage regime.

33919 **(LA-UR—84-1962) Geometry, contact, surface, and optical developments for photoconductive power switches.** Nunnally, W.C.; Hammond, R.B.; Wagner, R.S. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8406137—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014036.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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Photoconductive Power Switches (PCPSs) have the advantages of precise control, extremely fast closure times, extremely low inductances and scalability to very high voltages and currents. PCPSs have these advantages because the size or power of the switch is not related to its closure time. The closure time is determined by the external optical source that uniformly illuminates the PCPS between the electrodes. Because carriers are generated uniformly between the electrodes at the desired density, current can flow through the switch immediately without waiting for carrier transient delays. The operating voltage is determined by the switch length l, and the operating current is determined by the switch width w. The electrodes can be made as wide as desired so that the inductance can be extremely low, or the area available for heat removal can be increased and the entire switch brough into conduction at the same instant if the same optical pulse and path length are used. This paper describes recent research at Los Alamos that has improved PCPS contact fabrication technology, has developed a simple optical control illumination system using fiber optics and rectangular optics, and has improved photoconductor surface fabrication methods and processes for high electric field operation.

33920 **(ORNL/TM—9213) INTERMD: a computer program to predict intermodulation product generation on two-way FM radio frequencies.** Russell, J.A.; Case, A.L. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013767.

This report describes a computer program which was developed at the Oak Ridge National Laboratory to perform calculations on groups of two-way FM radio frequency assignments to determine if interference might be generated when two or more of the networks are used at the same time. Intermodulation products can be generated in a variety of ways, but the results have the same effect: the radio frequency signal generated appears to the receiver as a signal that cannot be distinguished from a signal actually transmitted on the receiver's input frequency. The purpose of INTERMD, the computer program described here, is to enable rapid determination, by calculation, of possible frequency combinations which could cause interference.

33921 **(SAND—83-2434C) Self-breakdown spark gap stability under rep-rate conditions.** Rinehart, L.F.; Buttram, M.T. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-8406137—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013126.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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We have measured the statistical distribution of self-breakdown voltages of a spark gap at very low repetition rates (< 1 Hz) and at 20 and 40 pulses per second. For the high repetition rate experiments, the test switch discharged a resistively charged energy storage capacitor into a resistive load producing a simple R-C relaxation waveform across the spark gap. Typical discharge parameters were in the 10 to 35 kV, 10 to 20 kA range with about 1 μs pulse width. For the low rate work, a 20% reversal ringing waveform was used to reach higher discharge currents (up to 100 kA). An on-line computer data acquisition system was used to record and process large numbers of breakdowns, thus producing good statistical samples. The data show two distinct instabilities. At high

currents (> 30 kA) those data that have a single simple distribution are of an extreme value form that is skewed toward low voltage. At low currents and higher repetition rates, the data evolve from a narrow dc (single pulse) breakdown voltage distribution into a broader Gaussian distribution at 20 pulses per second (pps) and finally to a very broad bimodal distribution (two Gaussians) at 40 pps. At 40 pps some firings occur as low as 30% of the mean. Effects of pressure and flow rate on the distributions are presented, and we discuss possible explanations for the origins of the distributions and their behavior.

33922 **(SAND—84-0353C) Dielectric breakdown distributions of large dielectric constant liquids.** Zutavern, F.J.; Buttram, M.T.; O'Malley, M.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 22p. (CONF-8406137—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013216.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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This paper reports area and time dependent dielectric breakdown distributions of ethylene glycol and water solutions cooled to -23°C. Electrode areas of 80, 400, 2000, and 10,000 cm^2 spaced 1 cm apart were repeatedly stressed with voltage pulses exponentially decaying in 5 to 20 ms. Approximately 80,000 measurements concentrated at electric field strengths near the 1% breakdown probability region of the samples were taken in order to obtain statistically accurate data on the dielectric strength of this liquid.

33923 **(UCRL—90154) Large aperture electro-optical switch.** Goldhar, J.; Henesian, M.A. (Lawrence Livermore National Lab., CA (USA)). 19 Dec 1984. Contract W-7405-ENG-48. 9p. (CONF-840629—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013089.

From 13. international quantum electronics conference; Anaheim, CA, USA (18 Jun 1984).

A transparent plasma electrode formed in low pressure ionized gas acts as a conductive coating to allow the uniform charging of the optical faces of an electro-optic material. Experiments with large aperture Pockels cells up to 27 cm are now in progress.

33924 **(UCRL—90295) Wafer-scale laser pantography. VI. Direct-write interconnection of VLSI gate arrays.** McWilliams, B.M.; Chin, H.W.; Herman, I.P.; Hyde, R.A.; Mitlitsky, F.; Whitehead, J.C.; Wood, L.L. (Lawrence Livermore National Lab., CA (USA)). 25 Jan 1984. Contract W-7405-ENG-48. 14p. (CONF-840139—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012676.

From SPIE technical symposium and instrument exhibit; Los Angeles, CA, USA (22 Jan 1984).

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General principles of laser direct-write deposition processes are reviewed: Device interconnection of CMOS gate arrays by means of computer-controlled, laser-induced thermochemical surface reactions is described. Interconnection quality parameters are related, and processing rate considerations are discussed.

4209 Waste Processing Plants And Equipment

33925 **(BMFT-FB-T—83-288) Recycling of various types of solvents, construction of a pilot plant, daily throughput: 8-10 tons.** Heyers, H.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1983. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751276.

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1) Large quantities of solvents, in particular halocarbons, are still incinerated at sea because the substances dissolved in them prevent recycling. 2) It was the aim and purpose of the research work to also reprocess and recycle such "problem solvents". 3) The fundamental prerequisites for the construction of a pilot plant were elaborated on the laboratory scale and the plant was then erected and tests carried out. 4) The specific design of the plant makes it possible also to distil off solvents which are partially polymerized or resinous. The residue is plastic or compact. In order to reduce costs, slightly contaminated, inflammable solvents which are not expensive enough to justify reprocessing can be used. 5) The principle underlying our plant permits economic reprocessing of solvents which have to date been incinerated at sea due to their heavy contamination.

33926 **(BMFT-FB-T—83-314) Construction and development of a resource recovery facility for household waste and commercial waste on a sanitary landfill.** Flender, H.F.; Trienekens, M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1983. 154p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751284.

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In October 1981 the first resource recovery facility for household and commercial waste, working on an technical scale, went into operation on an controlled sanitary landfilling, run by the M. Trienekens Company, Neuss, acting on behalf of the City of Neuss. The plant-promoted by the Minister for Research and Technology under assistance of the Federal Bureau of Pollution Control has a throughput capacity of 50 t/h household waste and 6.5 t/h commercial waste; the reclaimed products: paper (3 different qualites), plastics (foils), scrap, non-iron-scrap are sold directly for reprocessing to industry. The produced compost is used for land-recultivation purposes. The facility (dry processing) works satisfactory concerning machinery and quality of the products. The savable volume of the deposit amounts to 70-75%, with respect to the recyclable refuse. It is reported on the concept of waste disposal, the structure of marketing systems, the process-development and the first experiences of plant-operation.

33927 **(PB—84-157072) Profile of existing hazardous waste incineration facilities and manufacturers in the United States. Final report.** Keitz, E.; Vogel, G.; Holberger, R.; Boberschmidt, L. (Mitre Corp., McLean, VA (USA)). Feb 1984. 167p. NTIS, PC A08/MF A01.

A wide variety of technical data pertaining to hazardous waste incinerators has been obtained both from incinerator manufacturers and facilities operating hazardous waste incinerators. This document discusses the data gathering and verification procedures and presents tabulations of the data. It is estimated that there are approximately 350 operational hazardous waste incinerators at 270 facilities in the United States which are subject to regulation under the Resource Conservation and Recovery Act.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 32683, 32845, 33536

33928 **(AD-A—139961/7) Electrical spray modification with various fuels in a T-56 combustor. Contractor report.** Zajdman, A. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1984. 74p. (NPS—67-83-003CR). NTIS, PC A04/MF A01.

The possibility of electrically altering the droplet size distribution and injection cone angle of gas turbine fuel injectors has been investigated. The work was carried out both in a combustor rig incorporating a T-56 combustor liner/nozzle and in a non-burning spray optical absorption apparatus into each of which a high voltage electrode could be introduced. Several electrode designs were investigated in an effort to minimize flameholding and subsequent electrical shot circuiting. Fuels investigated included JP-4, the design fuel, JET-A, JP-5, and Diesel Fuel Number 2. Results of the optical experiments indicated reductions in the Sauter Mean Diameter of 7.7 percent. Results of the combustion experiments indicated increases in combustor efficiency of up to 3.6 percent for Diesel Fuel Number 2 and increases up to 0.6 percent for JP-4.

33929 **(DOE/ET/12307—1431) Design, construction, operation and evaluation of a prototype culm combustion boiler/heater unit. Quarterly technical progress report, April 1-June 30, 1982.** (Curtiss-Wright Corp., Wood-Ridge, NJ (USA)). Aug 1982. Contract AC21-78ET12307. 23p. (CW-WR—78-036.65). NTIS, PC A02/MF A01. Order Number DE84001061.

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This report provides a summary of the work performed on the prototype Culm Combustion Boiler/Heater Unit, Phase I - Engineering Design and Analysis, Phase II - Prototype Plant Construction and Phase III - Start-Up and Operation during the period April 1, 1982 through June 30, 1982. The objectives of the program as well as the technical progress and problem areas encountered during the reporting period are presented. The Parametric Test Program was resumed in April and completed during this report period. A total of 17 parametric test points have now been completed. During severe weather conditions (heavy rain), temporary delays were encountered due to the inability to crush sufficient amounts of culm for individual test points. Upon completion of the scheduled facility shutdown for maintenance, as discussed in the last report, the plant was restarted on April 5, 1982. Total operating time through the end of this quarter - 4272 hours, 29 minutes; operating time on culm/limestone and culm - 3379 hours, 15 minutes. Plant operating time during this report period - 1642 hours, 30 minutes with an operational running factor of 98.1% achieved during the month of June. Steam was delivered to the user (Cellu products) during this time to generate steam revenue. Data obtained during the Parametric Test Program was recorded on magnetic tape and this data was forwarded to DOE for their analysis.

33930 **(DOE/MC/19328—1320) Advanced atmospheric fluidized-bed combustion design-spouted bed. Final report.** Weller, A.E.; Murphy, M.J.; Schlaechter, J.; Shirley, F.W.; Dawson, W.J. (Battelle Columbus Labs., OH (USA)). 20 Dec 1982. Contract AC21-82MC19328. 119p. NTIS, PC A06/MF A01. Order Number DE83005060.

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A concept design for a spouted bed combustor/boiler was developed. The concept is based on a mechanical design derived from a fire-tube boiler and is thus restricted to relatively small boilers (say, 20,000 lb/hr and below) generating saturated steam at 250 psig or less. The spouted bed combustor/boiler is projected as having a number of advantages compared to conventional atmospheric fluidized bed combustion. These are greater turndown capability, improved calcium utilization, elimination of the need to withdraw solids, and a single point fuel feed. The spouted bed combustor shares the great fuel flexibility of the conventional fluidized bed combustor. Various coals, wood chips or waste and low grade solid, liquid and gaseous fuels can be burned. An R and D program to carry development of the spouted bed combustor/boiler through the PDU stage is provided. Also, recommendations for the design of a multiuse PDU support facility are made.

33931 **(N—8419495) Combustion characteristics in the transition region of liquid fuel sprays.** Cernansky, N.P.; Namer, I.; Tidona, R.J. (Drexel Univ., Philadelphia, PA (USA)). Jan 1984. 28p. (NASA-CR—175396). NTIS, PC A03/MF A01.

A number of important effects were observed in the droplet size transition region in spray combustion systems. In this region, where the mechanism of flame propagation is transformed from diffusive to premixed dominated combustion, the following effects have been observed: (1) maxima in burning velocity (2) extension of flammability limits (3) minima in ignition energy and (4) minima in NO(x) formation. Unfortunately, because of differences in experimental facilities and limitations in the ranges of experimental data, a unified description of these transition region effects is not available at this time. Consequently, a fundamental experimental investigation was initiated to study the effect of droplet size, size distribution, and operating parameters on these transition region phenomena in a single well controlled spray combustion facility.

33932 **(PB—84-179720) Firetube boiler fiber burner demonstration program. Annual report Sep 82-Oct 83.** Krill, W.V.; Kesselring, J.P. (Alzeta Corp., Mountain View, CA (USA)). Nov 1983. 80p. (R—83-703-102). NTIS, PC A05/MF A01.

First year activities of a 26 month program to demonstrate the durability of the radiant fiber burner in gas-fired firetube boilers are presented. These activities include selection of four industrial test sites, testing of a prototype segmented burner, design, construction, and installation of the four field test units, and field testing of the boilers with both conventional and fiber burners. The burner designs and potential control schemes for achieving various turndown capabilities are discussed. The unique aspects of each test site and installation are described, and the test results and benefits over the first seven months of testing are presented. Future plans for further burner modifications to reduce cost and enhance reliability are identified.

33933 **(PB—84-179738) Advanced furnace concepts - commercial unit heater. Annual report Sep 82-Oct 83.** Gotterba, J.A.; Schreiber, R.J.; Kesselring, J.P. (Alzeta Corp., Mountain View, CA (USA)). Oct 1983. 184p. (R—83-702-101). NTIS, PC A09/MF A01.

The first year of this planned 2.5 year project has been completed. The project's objective is to accelerate the commercialization of an advanced, condensing, commercial warm air furnace, or unit heater. The heater will use a gas-fired infrared fiber burner manufactured by the performing organization. The first activity was the performance comparison between a conventional heater and the same heater retrofit with a fiber burner. The new burner achieved an 80 percent decrease in NOx emissions, a significant drop in noise output and no adverse effect on thermal efficiency. After these promising retrofit results, the heat exchanger was modified in various ways to attempt to achieve condensing operation. Higher efficiency was attained when the conventional heat exchanger was inverted and an additional convective tube bundle was installed upstream of the room air blowers. Activities during the project's second year will include evaluating this modified heater in the field, and using the results to design, fabricate, and field-evaluate an entirely new heater using the fiber burner and a condensing heat exchanger.

4220 Underground Engineering

33934 **(BMFT-FB-T—84-009) Development and testing of a new support-integrated system for heading roads in coal and rock.** Boermann, P. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Ruhrkohle A.G., Essen (Germany, F.R.)). Jan 1984. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751280.

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The project initially covered the development of a so-called "roadway helix" for rectangular (porch set) and arch-shaped roadways. In the concept phase it was found that it would be impossible to accomplish the assigned task by a single system design. The project, therefore, was subdivided, and priority was given to the development of an efficient point attack machine for heading arch-shaped roadways into the rock. Due to the budgetary situation of the Federal Government, the cancellation of the project with date of December 31st, 1980, was asked for. Due to the contractual obligations Ruhrkohle AG had engaged meanwhile, the system testing of the TSM E 200 machine which Messrs. Paurat was at the point of supplying was approved for a period ending December 31st, 1982. In June 1981 the machine started operation on the 703 m level of Rossenray colliery. In heading operations it was found that the machine actually can cut into rock which, due to its content of abrasive minerals, was previously deamed to be out of application scope of cutting machines, however, that the tool costs were beyond of economic viability. Due to the difficult geological conditions, the heading performance up to present was 1.17 fm^3/min only.

33935 **(CONF-8405144—3) Hydrogeologic assessment of zone-of-saturation landfill design.** Smith, E.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012356.

From International groundwater symposium; Montreal, Quebec, Canada (21 May 1984).

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Disposal of solid waste below the water table violates most conventional wisdom on sound waste disposal practice, which holds that solid wastes should be isolated from groundwater to min-

imize leachate generation and to allow migrating leachate to be attenuated by passage though unsaturated soil before it reaches the water table. In the State of Wisconsin (USA), however, landfilling in the zone of saturation has become an accepted practice in low-permeability hydrogeologic settings, where conditions appear to make it possible to prevent leachate from escaping the landfill by controlling hydraulic gradients. This paper explores the merits and drawbacks of this novel landfill design concept, based on fundamental hydrogeologic concepts and on some lessons learned from the 10-year record of operation of zone-of-saturation landfills in Wisconsin. 19 references.

33936 **(NP—4770333) Annual report of the Clausthal-Zellerfeld Board of Mines 1982.** (Oberbergamt Clausthal-Zellerfeld (Germany, F.R.)). 1982. 189p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770333.

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In the Board of Mines district that includes Lower Saxony, Schleswig-Holstein, Hamburg, Bremen and Berlin the value of extraction increased by 839 million DM to 8.362 thousand million DM, which is a 400% increase within 10 years. 258 (246) mines were under the control of the Board of Mines, with 16859 employees 714 of which were foreigners. In the year under report, the last mine extracting iron ore was shut down in Haverlahwiese. The raised and weighed tonnage in metal ore increased by 0.6%, yet the utilizable amount decreased by 2.9% to 135765 tons. Examinations of deposits were successful at the "Hilfe Gottes" mine. Activities at the underground storage plants for natural gas and petroleum equaled the figures of the preceding year; 200 were employed. At the "Schachtanlage Konrad" a closing report of investigations carried out by the German Radiation and Environment Research Association concluded that the mine qualifies for the ultimate storage of slightly radioactive waste and waste from decommissioning of nuclear facilities. As for regional policy planning, it took a great deal of effort to guarantee that the public interest in mining is given due consideration, so that mining project requiring a lot of space are on principle practicable in the future.

4230 Marine Engineering

33937 **(GKSS—83/E/24) MIG-welding of offshore steels at pressures from 1 to 30 bar.** Terlinde, G.T.; Mueller, L.G.; Schwalbe, K.H.; Beaven, P.A.; Szelagowski, P. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 10p. (CONF-830514—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751288.

From Offshore technology conference; Houston, TX, USA (2 May 1983).

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Hyperbaric welding was performed in an unmanned chamber at pressures up to 30 bar (300 m depth). A flux-cored and a solid wire were used as consumables; two typical offshore steels served as base materials. The study, which mainly focussed on the weld metal properties, included chemical analysis, detailed microstructural characterization, tensile and charpy impact testing, and for selected conditions a fracture mechanics analysis. When using argon as pressurizing gas, the impact toughness decreases only slightly at higher pressures (<15%); the room temperature tensile properties and COD values for crack growth initiation show no pressure dependence. The solid wire has slightly lower impact toughness values than the flux-cored wire. An attempt is made to explain the mechanical properties on the basis of the observed microstructures.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 34230

33938 **(BMFT-FB-T—84-069) Ground probing of contaminated sites.** Feld, R.; Kaul, J.; Kimball, S.; Koennecke, R.; Sandness, G.; Stammler, M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1984. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751776.

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Using geophysical methods such as radar probing, determination of ground conductivity by electromagnetic induction and recording of magnetic anomalies, 11 contaminated sites were investigated. The objective was to detect and locate deposited contaminantes, burried objects and pathways of pollution plumes. The application procedures of these methods are described. The proposed future development of the methods is to improve data collection systems and analysis.

33939 **(NE/FBA—83-17) Review and evaluation of novel flue gas purification technology for advanced flue gas purification.** Nilsson, B. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1983. 203p. (In Swedish). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84751018.

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The methods for flue gas purification have been reviewed. Advanced purification is defined as a method giving 10% of the release wich is attained by todays technique. A considerable reduction of costs at the present day level of emissions may also be considered. The present methods are recommended to further studies: -UW Electrostatic Scrubber -Electrostatic fluidized bed -Elecrtoscrubber -Blocking filters -Electric filters -Radiation treatment (G.B.).

33940 **(PB—84-148766) Limestone scrubber slurry automatic control systems. Final report Mar 78-Mar 81.** Garrett, P.H. (Cincinnati Univ., OH (USA)). Jan 1984. 93p. NTIS, PC A05/MF A01.

The report utilizes current understanding of limestone scrubbers for flue gas desulfurization (FGD) to develop an effort into the optimization of automatic control for the recirculating slurry processes. The acknowledged methods of mathematical modeling, computer simulation, and experimental proofing are applied to the design of slurry limestone addition, slurry density, and absorber liquid-to-gas (L/G) ratio control systems. Three automatic control methods are analyzed for dense limestone feedrate to the recirculating slurry: stoichiometric control, pH control, and stoichiometric-assisted pH control. Absorber L/G ratio control for minimizing scrubber energy requirements while maintaining an SO_2 exit target is also designed, based on a feedforward SO_2 removal law and slurry pump selection.

4250 Power Cycles

REFER ALSO TO CITATION(S) 33552

43 PARTICLE ACCELERATORS

33941 **(SLAC-PUB—3357) Future of high energy physics.** Panofsky, W.K.H. (Stanford Linear Accelerator Center, CA (USA)). Jun 1984. Contract AC03-76SF00515. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013513.

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A rough overview is given of the expectations for the extension of high energy colliders and accelerators into the xtremely high energy range. It appears likely that the SSC or something like it will be the last gasp of the conventional method of producing high energy proton-proton collisions using synchrotron rings with superconducting magnets. It is likely that LEP will be the highest energy $e+e^-$ colliding beam storage ring built. The future beyond that depends on the successful demonstrations of new technologies. The linear collider offers hope in this respect for some extension in energy for electrons, and maybe even for protons, but is too early to judge whether, by how much, or when such an extension will indeed take place.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 32696, 34893, 34969

33942 **(DOE/ER/40048—83-L3) Conceptual design report: superconducting booster.** (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 22 Sep 1983. Contract AC06-81ER40048. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013830.

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The Superconducting Booster project includes the construction of a new high-voltage injector and buncher for the existing tandem, a magnetic transport system, an rf linac with superconducting resonators, and a rebuncher-debuncher. The booster will fit in existing space so that a new building is not required. The layout of the accelerator is given in Fig. I-1. The University of Washington is contributing approximately $1 M to this project.

33943 **(GSI—83-10) Possibilities for the study of dense, hot matter with a heavy ion synchrotron.** Brezina, I.; Wollnik, H.; Arnold, R.; Meyer-ter-Vehn, J.; Beckert, K.; Bock, R.; Boehne, D.; Hofmann, I.; Mueller, R.W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Nov 1983. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751436.

The possibility of making experiments on heavy ion fusion (accelerator and target physics) and on matter research at high pressure and temperatures (solid-state density, $p > 10$ Mbar, $T > 200000°$ K) is studied. The accelerator-physical limits of the radiation intensity to be expected in the high-current operation are discussed and used for the derivation of scaling laws. As a reference case a 18 tesla-meter synchrotron (final energy 330 MeV/amu for I^{20+}) is considered.

33944 (INIS-mf—8365, pp 114-117) **Tritron.** Hinderer, G.; Trinks, U. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33945 (INIS-mf—8365, pp 102-103) **Superconducting sector cyclotron SuSe.** Czech, W.; Daniel, H.; Dietl, L.; Dorner, E.; Graw, G.; Hinderer, G.; Kellner, E.; Kienle, P.; Koerner, H.J.; Labedzki, J. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33946 (INIS-mf—8365, pp 103-105) **SuSe test coil.** Czech, W.; Kellner, E.; Labedzki, J.; Mitwalsky, A.; Savoy, R.; Schneider, U.; Smolic, E.; Trinks, U.; Wiedemann, W.; Willers, H.G. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33947 (INIS-mf—8365, pp 105-109) **RF-accelerating system for SuSe.** Dorner, E.; Wilhelm, W. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33948 (INIS-SU—221, pp 51-54) **LUER-40M medicine linear accelerator structure.** Vakhrushin, Yu.P.; Vorogushin, M.F.; Nikolaev, V.M.; Ryabtsov, A.V.; Svistunov, Yu.A.; Smirnov, V.L.; Smirnov, Yu.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

Parameters of the Well-known standing wave accelerating structures to choose a working strUctUre for the LUEhR-40M medicine accelerator are analyzed. For estimations the data obtained in NIIEhFA, MIFI, MPTI, IYaI and foreign laboratories are used. A biperiodic decelerating system with internal coupling cells is accepted as a working one. The shunting resistance of such a system and numerical simulation of particle dynamics inLUEhR-40M have shown that 21 MeV electron energy can be obtained at 1.6 m accelerating system length.

33949 (INIS-SU—221, pp 20-22) **Reconstruction of a heavy ion linear accelerator.** Bomko, V.A.; Rudyak, B.I.; Skoromnyj, G.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

Developments and studies of systems and units of the Kharkov high-efficiency heavy ion accelerator RF-system, strong-focusing channel, ion-optical beam guidance system, cryogenic system, vacuum system are described. On the basis of the obtained results reconstruction works on the multicharged ion linac are carried out to increase the beam intensity and eXpand the mass range.

33950 (INIS-SU—221, pp 12-19) **Electron linear accelerators for radiotherapy.** Vakhrushin, Yu.P.; Prudnikov, I.A.; Chichikalov, Yu.F.; Shakhov, V.I. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

Present-day requirements for radiotherapy equipment are considered. The recently developed linacs of LUE-5, LUE-25, LUE-15MM models, as well as a newly designed unified series of medical linacs of LUER-5M, LUER-20M, LUER-40M models are described in brief. The main scientific and technical problems that were solved during their construction, namely, development of accelerating structures, a radiation head, dosimetry equipment, a programming unit, a magnetic mirror etc. are described.

33951 (INIS-SU—221, pp 7-11) **"Fakel" accelerator work state and some results.** Petrenko, V.V.; Chernoplekov, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

The operating condition of the "Dakel" accelerator and some systems for the two-year period (1981-1982) are analyzed. The physical research program is discussed and the results of using the operating time with beams for different branches of research (nuclear physics and neutron constants, physics of hydrogen in extreme conditions, radiation physics of semiconductors, radiation physics of electron channelling, accelerator physics and technology, synchrotron complex) are given. The up-dated accelerator systems are described; the most important ones increase of reliability and durability of modulator elements and clystron excitation power. The achieved beam parameters (e.g. at 20 ns pulse duration accelerated electron energy is 60 MeV, pulsed current is 5A) are presented. Information about the progress in synchrotron radiation source construction is given.

33952 (INIS-SU—221, pp 67) **3-cm cryogenic linac (design parameters).** Saverskij, A.Ya.; Shchedrin, I.S. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33953 (INIS-SU—221, pp 70-71) **Electron linac universal accelerating cell.** Ajzatskij, N.I.; Dyukov, S.N.; Makhnenko, L.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33954 (INIS-SU—221, pp 71) **Computer calculation of high-current electron linac electrodynamic parameters.** Arsen'ev, V.V.; Bezrodnyj, Yu.G.; Bomko, V.A.; Meleshkova, Yu.V.; Skoromnyj, G.M.; Khizhnyak, N.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33955 (INIS-SU—221, pp 74) **Calculating the parameters of losses due to spurious modes in linac accelerating structures.** Bukharin, V.L.; Tret'yakov, A.G.; Tapalov, S.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33956 (INIS-SU—221, pp 74-75) **Developing the package of service programs for electron linac calculation.** Vagina, V.V.; Gusarov, V.N.; Danilov, V.D.; Zobov, M.M.; Ma orov, Yu.K. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33957 (INIS-SU—221, pp no.2(14)) **Transients calculation in a three-section electron accelerator taking into account current loads.** Stepnov, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33958 (INIS-SU—221, pp 80) **Quantum mechanical restrictions for limiting possibilities of precise beam production in linear accelerators.** Shenderovich, A.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33959 (INIS-SU—221, pp 86) **Studying the fine structure of beam current pulses in an electron waveguide accelerator.** Glazunov, P.Ya.; Neponyashchi , O.N.; Polkovnikov, B.K.; Pavlov, Yu.S.; Solov'ev, N.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33960 (INIS-SU—221, pp 87) **Mathematical description of the 10 MeV three-section electron linac.** Gubanov, A.V.; Mel'nikov, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33961 (INIS-SU—221, pp 94) **Problems of intensive multicharged ion beam generation in pulse electrostatic accelerators.** Bystritskij, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33962 (INIS-SU—221) **Physical experiment technique.** (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. 113p. (In Russian). (CONF-8306180—No.2(14)). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780353.

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

Abstracts of individual items from the seminar were prepared separately for the data base. (GHT)

33963 (INIS-SU—223, pp 67-68) **Circuit for control and stabilization of beam mean current in electron linear accelerator.** Borzhkovskij, V.F.; Stervoedov, N.G. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Kostenets, Yu.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780351. (CONF-8106218—No.1(10)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A circuit for control and stabilization of beammean current intended fop electron linear accelerator uynchponization system is suggested. Control and stabilization of mean current is exercised by change of the number of current pulses per unit of time at preservation of pulsed current and other beam parameters of accelerated electrons electrons without change. Change of the number of current pulses per unit of time is realized by delay of the necessary part of klystron startup pulses (KIU) of the source modulator in time in respect to moments of time of startup of the KIU accelerating sections. Control step of mean current is equal to 1.56%. Stabilization coefficient equals 64.

33964 (INIS-SU—223) **Physical experiment technique.** (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 101p. (In Russian). (CONF-8106218—No.1(10)). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780351.

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

33965 (LBL—17719) **Supercollider physics.** Hinchliffe, I. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 34p. (CONF-8403130—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013237.

From 4. topical workshop on proton antiproton collider physics; Bern, Switzerland (5 Mar 1984).

Several unsolved problems concerning backgrounds prevent one from claiming that some particular signal is clearly observable. One of the most critical issues concerns the observability of W's and Z's from their decays into hadronic jets. Many signals for new physics involve final states with W's or Z's (e.g. the minimal Higgs discussed in D). If one is restricted to observing the W's and Z's via their leptonic modes (which may not be possible for final states involving more than one W) only a small number of events will be detected - 5000 Z pairs decaying into ee and $\mu\mu$ results in only 18 detected events. The physics background to hadronic decays of W and Z is from QCD events with multiple jets. In the case of final states with 4 jets we have no reliable QCD estimate. Many particle searches (e.g. supersymmetric ones) involve signals which have missing transverse momentum, so the importance of hermetic detectors with 4 π coverage cannot be overstated. The difference between a pp and a proton-antiproton collider is limited to a few special cases where the presence of valence antiquarks in the antiproton is important (for example is the production of a new W). In order to exploit this advantage a certain minimum luminosity is required. ($\sim 5 \times 10^{31}$ cm^{-2} sec^{-1} for $\sqrt{s} = 40$ TeV). A 40 TeV machine operating at a luminosity of at least 10^{33} cm^{-2} sec^{-1}, seems capable of answering the fundamental questions surrounding the breaking of weak interactions. The same assurance cannot be given for a 10 TeV Machine at the same luminosity. 23 references, 23 figures.

33966 (ORNL/TM—8669) Preliminary study of possible ORELA replacement options. Olsen, D.K.; Martin, J.A.; Horen, D.J. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013133.

Based on two conceptual design studies performed by the LANL Accelerator Technology Division, the possibilities in terms of accelerator systems for replacing ORELA with a more intense Maxwellian-type continuous-energy neutron source are summarized and discussed. The neutron intensities from ORELA are compared with those from existing or potential accelerator systems used for cross-section and condensed-matter studies. The best replacement options seem to involve a spallation source from 200- to 400-MeV protons on an ORELA-like target. Pulsing and intensity desiderata with such a source are discussed which correspond to a spectrum-averaged 100-fold improved figure of merit over ORELA for TOF measurements with only a tenfold increased source strength. Existing accelerator designs seem to be inadequate for such a source. Consequently, two conceptual designs were developed for this study by the LANL Accelerator Technology Division. The first conceptual design is for a 200-MeV large linac capable of accelerating 1.3 A during a macropulse; this linac standing alone could serve as an ORELA replacement source. The second conceptual design is for a much smaller 250-MeV PIGMI linac with a 28-mA macropulse current which feeds a proton accumulator ring and bunch-compressor transport line. This linac-ring-compressor (LIRIC) option would give a more cost-effective neutron source for cross-section measurements, whereas the large linac, or a modified version of it, would give a much simpler system more suitable for expansion. In particular, both conceptual designs would incorporate the present ORELA building and would provide approximately 100-fold improved neutron sources over ORELA for cross-section measurements. The total estimated cost of the LIRIC system would be $43M (1984), whereas the cost of the large linac would be about a factor of two more. 55 references, 11 figures, 19 tables.

33967 (SAND—84-0529C) Development of the pulse compression section for PFBA II. Turman, B.N.; Seamen, J.F.; Neau, E.L.; Humphreys, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-8406137—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013125.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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A single-module demonstration experiment for the Particle Beam Fusion Accelerator (PBFA-II) is nearing completion. The pulse-forming line for this module uses traveling wave charging, and the energy efficiency of the module varies from 22% for a 40 ns power pulse to 35% for a 55 ns power pulse. With a 370 KJ Marx generator, this module can deliver up to 130 KJ into a matched 2.2 ohm output line. 6 references, 6 figures, 2 tables.

33968 (UCRL—90394) Operating experience with the 50 MeV 10kA ATA power conditioning system. Rogers, D.; Lee, F.D.; Newton, M.; Reginato, L.L.; Smith, M.E. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 6p. (CONF-8406137—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012806.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

The Advanced Test Accelerator (ATA) has been operational for over one year and has achieved full parameters in the power conditioning system. The pulsed power system has been previously described, however, during the past year of operation a considerable amount of statistical data has been accumulated on the 211 gas blown spark gaps that perform the main switching function in the ATA. These spark gaps were designed for 250kV, 40 kA and 70ns pulse. The parameter that made this spark gap somewhat unique was the requirement that it be able to provide a burst of ten pulses at one kilohertz with an average repetition rate of 5Hz. 2 references, 7 figures.

33969 Overview of CW electron accelerator proposals. Norum, B.E. (Dept. of Physics, Univ. of Virginia, Charlottesville, Virginia 22901). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3250-3251(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Electron beams in the MeV to GeV energy range have been used for nuclear studies for the last thirty years. The precision of measurements made using electrons is sufficiently high that they are also now used as starting points for the analysis of data obtained using strongly interacting probes such as pions and protons. Virtually all measurements made to data have been of the inclusive variety. Enhancing the precision of such measurements, through such means as more accurate particle differentiation and improved time resolution, has meant making the duty factor of the beam as high as possible. The global interest in high duty factor electron accelerators has consequently risen. This paper groups both existing and proposed high duty factor accelerators into three categories. The first group covers those involving a pulsed accelerator and a pulse stretcher ring. The second category consists of machines based on the microtron concept. The third group includes the recirculated linac. The current proposals for high duty factor accelerators are divided into two groups: those involving the upgrade of an existing pulsed accelerator and those involving the construction of a new accelerator. The proposals for new accelerators are further categorized into those based on linac pulse stretcher combinations and those based on microtrons. This paper assesses the existing and proposed activities of these facilities as they currently stand at laboratories around the world.

33970 GEM, ANL 4-GeV CW electron microtron design. Kustom, R.L. (Phys. Division, Argonne Nat.'l Lab., 9700 S. Cass Ave., Argonne IL 60439). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3286-3290(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A six-sided hexagonal microtron has been chosen as the accelerator to generate the beams required to pursue a national research program at a CW 4 GeV electron laboratory. This option has the advantages of superior beam quality, low capital and operating cost, and promise of furnishing beams of several electron energies simultaneously. Only moderate RF power is required because the electron beam will be accelerated through the same RF accelerating section many times. The hexatron design has the additional feature of compatibility with an existing accelerator complex at Argonne which is currently unoccupied and available. The basic components of the accelerator include an electron gun, chopper-buncher, a 23 MeV linac injector, a 23-185 MeV Racetrack Microtron, an interstage phase space matching section, a subharmonic cavity, a 185-400 MeV Six-Sided Microtron, extraction systems, and various transport lines. The 100 KeV beam will be injected into a 2 MeV linac capture section which will be followed by a 3 MeV preaccelerator section. Acceleration to 23 MeV will be accomplished by 8 sections of linac consisting of on-axis-coupled structure. The beam will be injected into the Racetrack Microtron and accelerated to 185 MeV in 27 revolutions with a 6 MeV gain per turn. This paper describes the design, operation and performance of the microtron and its components.

33971 Medium energy proton accelerator for therapy. Gottschalk, B. (Harvard Cyclotron Lab., 44 Oxford St., Cambridge, MA 02138). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: 3063-(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Harvard Cyclotron Laboratory is designing a small synchrotron to make low-current adjustable-energy proton beams for radiotherapy. The specifications include an adjustable range of 50 to 250 MeV; an 0.1 microamp average in 10 pulses per second; a size of 6 by 6 meters; a weight of 5 tons; and a prototype cost of ca. $400 K. The magnet offers a field on design orbit of 1 KGauss (injection) and 12 KGauss (250 MeV); a four quadrant alternate-gradient 4 x (O d F D D d O) lattice; a bending radius of 2 m; a

gross radius of 3.2 m; four 2 m straight sections; split H laminations; and an aperture of 1.5 x 4.5 cm. The magnet coil consists of ca. 20 turns with a single coil per quadrant, is strip-wound and edge-cooled, and has an effective area of .0007 m^2. Its electrical and magnetic specifications are listed. The injector consists of an RFQ linac, matched to a DC beam at both ends, a 50 keV ion source, a partly lumped resonator, and is driven by Y690A planar triodes. While these and other specifications such as the rf characteristics and output energy are design rather than empirical specifications and are, therefore, subject to change, they serve to define the general character of the synchrotron.

33972 **LLL experiments in collective field acceleration.** Luce, J.S.; Bostick, W.H.; Nardi, V. (Lawrence Livermore Laboratory, Livermore, CA 94550). pp 437-448 of Energy storage, compression and switching. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—). Contract W-7405-ENG-48.

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter describes a collective field accelerator (CFA) developed at the Lawrence Livermore Laboratory (LLL) which operates with a vacuum diode. This diode utilizes a graphite cathode and a dielectric anode that operates with a relativistic electron beam. The CFA experiments are conducted with the LLL Pulserad 422 e-beam machine. Discusses the status of the LLL-CFA program and future research programs. Many fundamental questions remain unanswered, such as the role of the plasma filaments.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 33958, 34060, 34063, 34107, 34787

33973 **(AD-A—137508/8) Modified betatron accelerator studies. Final report 1 Sep 81-31 Oct 83.** Hughes, T.P.; Godfrey, B.B.; Campbell, M.M. (Mission Research Corp., Albuquerque, NM (USA)). Dec 1983. 158p. NTIS, PC A08/MF A01.

Results of an extensive study of the modified betatron accelerators are reported. The topics are beam injection, equilibrium and stability. Three-dimensional particle simulations of injections were performed. The results show good agreement with theory. Various types of equilibria were studied using two dimensional simulations. Results are compared to the calculations of Finn and Manheimer. Beam stability is investigated using a combination of analytic and numerical techniques. Growth rates of the negative mass, resistive wall, beam breakup, and image displacement instabilities are calculated. A new theory of the negative mass instability, keeping toroidal corrections to Maxwell's equations, is derived. Good agreement between theory and simulations is obtained. The negative mass instability is shown to be the dominant instability. Simulations show that it can disrupt the beam in a time of order one microsecond. Stabilization may require a beam of large minor radius. Work on the other instabilities show that measures can be taken to make their effect negligible.

33974 **(BNL—34758) Software for large scale tracking studies.** Niederer, J. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 4p. (CONF-8405162—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013233.

From Symposium on recent developments in computing, processor, and software research for high-energy physics; Guanajuato, Mexico (8 May 1984).

Over the past few years, Brookhaven accelerator physicists have been adapting particle tracking programs in planning local storage rings, and lately for SSC reference designs. In addition, the Laboratory is actively considering upgrades to its AGS capabilities aimed at higher proton intensity, polarized proton beams, and heavy ion acceleration. Further activity concerns heavy ion transfer, a proposed booster, and most recently design studies for a heavy ion collider to join to this complex. Circumstances have thus encouraged a search for common features among design and modeling programs and their data, and the corresponding controls efforts among present and tentative machines. Using a version of PATRICIA with nonlinear forces as a vehicle, we have experimented with formal ways to describe accelerator lattice problems to computers as well as to speed up the calculations for large storage ring models. Code treated by straightforward reorganization has served for SSC explorations. The representation work has led to a relational data base centered program, LILA, which has desirable properties for dealing with the many thousands of rapidly changing variables in tracking and other model programs. 13 references.

33975 **(DESY-L-Trans—283) Electromagnetic radiation during the flight of relativistic particles through a small section of the force field.** Bonch-Osmolovskii, A.G.; Lyuboshits, V.L.; Podgoretskii, M.I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751488.

Translated from Russian. Published as report JINR-P–2-83-157.

The low frequency part of the spectrum of the electromagnetic radiation arising at a change of the velocity direction of an ultrarelativistic charged particle within a certain section of the force field of finite length l is investigated. It is shown that the correction to the spectrum-angular density of radiation corresponding to an instantaneous change of velocity has magnitude of an order of (l/Lsub(F)) where Lsub(F) = $2cy^2/\omega(1+y^2\text{theta}=2)$ is the formation length, ω is the radiation frequency, y is the Lorentz-factor, theta is the angle between the longitudinal velocity of a particle and the direction of radiation. At the same time the correction to the spectrum density, after integrating over angles, turns out to be proportional to the length of an intermediate interval, but not to the square of this length.

33976 (INIS-mf—8365, pp 89) **Double-drift buncher.** Rohrer, L.; Hegewisch, S.; Jakob, H.; Rudolph, K.; Skorka, S.J. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33977 (INIS-mf—8365, pp 94-95) **Status of the heavy-ion post accelerator.** Gaertner, N.; Geier, R.; Gustavsson, S.; Morinaga, H.; Nolte, E.; Ratzinger, U. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33978 (INIS-mf—8365, pp 111-114) **Calculations of the magnetic field and beam dynamics for SuSe.** Schott, W.; Zech, E. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33979 (INIS-mf—8365, pp 111) **Beam transport between SuSe and the experimental areas.** Hinderer, G.; Hinterberger, F. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

33980 (INIS-SU—211, pp 16-18) **Theory of cross instability of relativistic electron rings.** Bulyak, E.V.; Kurilko, V.I. 1982. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI84780255.

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In Technique of physical experiment.

Self-coordinated hydrodynamic theory of dipole instability of relativistic electron circular beam homogeneous in density relatively to self-excitation of collective dipole cross oscillations of this beam and positive ions captured by volumetric charge, is devel-

oped. It is shown that self-excitation of surface and volumetric types of oscillations threshold currents of which differ by 2 times and the increments are approximately similar take place in the system considered.

33981 (INIS-SU—211, pp 43-45) **Influence of electric field dipole component on ion motion in linear accelerator with phase-alternating focusing.** Baev, V.K.; Gavrilov, N.M.; Minaev, S.A. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI84780255.

Microfiche only, copy does not permit paper copy reproduction. Original copy available until stock is exhausted refs.; 1 fig.

In Technique of physical experiment.

The effect of electric field dipole component on ion motion in the accelerating system built on the base of two-wire resonator (according to the Videroe scheme), is considered. The dipole component is caused by the variable difference of potentials between the conductors of the resonator. The equation of motion is drawn which is investigated by analytical methods. Conditions for resonances excited by dipole component are obtained; the increase in ion oscillation amplitude relatively to equilibrium particle in the case of their motion under resonance conditions, are obtained.

33982 (INIS-SU—221, pp 84) **Vavilov-Cherenkov radiation application for measuring spectra of accelerated electrons.** Vajner, E.A.; Ponomarev, V.N.; Trukhanov, K.A.; Filin, L.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33983 (INIS-SU—221, pp 43-50) **Development of linear accelerators with radial lines excited by an external pulse generator.** Zakutin, V.V.; Shenderovich, A.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

The revieW presents the results of theoretical and experimental studies of accelerating field generation and electron beam acceleration by radial lines excited by an external pulsed generator carried out in the USSR and abroad in recent years. Various versions of accelerating structures, connection diagrams special for generating a nonpotential electpic field to design multi-gap accelerating systems are proposed in these papers. Different excitation circuits are considered and the possibility of reaching 100% efficiency of energy transfer to the beam is shown. As a result of theoretical studies it is shown that accelerating voltage per a cell significantly exceeding feeding voltage can be aenerated. The dependence of the effect on line parameters and excitation pulse is studied. The obtained results are verified in experiments when hundreds amp electron beams are accelerated in a single radial line and in a mUlti-gap system of radial lines, and its main regularities are studied. On the basis of the given method compact accelerators of electron beam with current of hundreds of amperes and pulse duration of several nanoseconds can be designed.

33984 (INIS-SU—221, pp 23-31) **Methods of monoenergetic beam production in electron linear accelerators.** Dovbnya, A.N.; Shendrik, V.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.); Kalashnikov, V.V.; Petrenko, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

A review of methods for monoenergetic beam production in electron linacs for the recent years carried out in the USSR and abroad is presented. Results of theoretical and experimental investigations of operating systems of eperaetic beam compression in different accelerator centres are discussed. The main dependences of performance on differept beam parameters for such systems are given. A proposition concerning construction of energy phace compression systems is made. Some estimations are given for the systems. The possibilities of their utilization and advantages over the previously used methods for decreasing the bunch phase width and electron energy spread are pointed out.

33985 (INIS-SU—221, pp 63) **Possibility of accelerating field subnanosecond pulse generation by means of radial lines.** Zakutin, V.V.; Shenderovich, A.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33986 (INIS-SU—221, pp 71) **Calculation of nonrelativistic electron flux potential in conducting shields.** Aseev, G.G.; Kuznetsova, G.G.; Lymar', A.G.; Repalov, N.S.; Khizhnyak, N.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33987 (INIS-SU—221, pp 72) **Dynamics of single bunch radiation fields in accelerating structures.** Balakin, V.E.; Novokhatskij, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33988 (INIS-SU—221, pp 73) **Electrodynamic model of transients during charged particle bunch motion through a resonator.** Bukharin, V.L. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33989 (INIS-SU—221, pp 75) **Developing a system for formation of figure profiled irradiation fields at an electron linac.** Vikulov, V.F.; Vinogradov, K.A.; Gubanov, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33990 (INIS-SU—221, pp 76) **Calculating a particle beam radiation in a periodic structure.** Volodin, V.A.; Obraztsov, N.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33991 (INIS-SU—221, pp 76) **Defocusing of modulated electron flux in the region of longitudinal magnetic field decrease.** Dovbnya, A.N.; Repalov, N.S.; Tur, Yu.D. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33992 (INIS-SU—221, pp 77) **Two-sided algorithms for calculating electric and magnetic fields in resonators of complex shape.** Kalinichenko, V.I.; Koshchij, A.F.; Ropavka, A.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33993 (INIS-SU—221, pp 77) **Bremsstrahlung dose rate during electron scattering in a beam transport channel.** Kudinov, V.V.; Smirnov, V.V.; Sukharev, A.A.; Tsygankov, E.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33994 (INIS-SU—221, pp 78) **Radiation field numerical simulation.** Novokhatskij, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33995 (INIS-SU—221, pp 78) **Spatial-time and spectral characteristics of diffraction radiation of a point charge moving along the axis of a circular waveguide section.** Pazynin, L.A.; Sologub, V.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33996 (INIS-SU—221, pp 79) **Radial dynamics of a beam in the 3-cm linear electron accelerator for the energy of 3.0 MeV.** Polyakov, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33997 (INIS-SU—221, pp 79) **Electromagnetic field structure in a cylindrical H-resonator loaded with a ferrite sphere.** Popov, V.A.; Cherkasova, K.P.; Khizhnyak, N.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33998 (INIS-SU—221, pp 80) **Analytical studying of the process of particle capture in the field of travelling electromagnetic wave.** Kholodov, V.I.; Khizhnyak, N.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

33999 (INIS-SU—221, pp 93) **Technique for studying ion dynamics in linear accelerators with focusing by axially symmetric accelerating filed.** Baev, V.K.; Naumov, A.Eh.; Rassadin, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34000 (INIS-SU—221, pp 94) **Studying the numerical models of ion beam dynamics in shaping and accelerating systems.** Batygin, Yu.K.; Rassadin, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34001 (INIS-SU—221, pp no.2(14)) **Comparative diagnostics of intensive ion beams.** Bystritskij, V.M.; Krasik, Ya.E.; Chistyakov, S.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34002 (INIS-SU—221, pp 96) **Measuring the low intensities of multicharged ion beams.** Gusev, E.V.; Demchenko, P.A.; Koval'chuk, I.K.; Krivulya, S.Yu.; Shchulika, N.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34003 (ORNL/TM—8880) **ORELA flight path 1: determinations of its effective length vs energy, experimental energies, and energy resolution function and their uncertainties.** Larson, D.C.; Larson, N.M.; Harvey, J.A. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 95p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013594.

Flight path 1 at ORELA is nominally 200 m in length and has been extensively used for neutron transmission and scattering measurements. Due to moderation effects in the neutron-producing target and to the finite thickness of the neutron detector, the effective flight-path length is a function of neutron energy. In this report, we determine the effective length as a function of energy, its uncertainty, and time-of-flight energies and their uncertainties. Finally, we determine the resolution function and its uncertainty and compare the width of this resolution function with an experimental determination of this quantity. 9 references, 5 figures, 4 tables.

34004 (UCRL—90858) **Optical loop framing.** Kalibjian, R.; Chong, Y.P.; Prono, D.S.; Cavagnolo, H.R. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 7p. (CONF-8406133—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012799.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

Portions are illegible in microfiche products.

The ATA provides an electron beam pulse of 70-ns duration at a 1-Hz rate. Our present optical diagnostics technique involve the imaging of the visible light generated by the beam incident onto the plant of a thin sheet of material. It has already been demonstrated that the light generated has a sufficiently fast temporal reponse in performing beam diagnostics. Notwithstanding possible beam emittance degradation due to scattering in the thin sheet, the observation of beam spatial profiles with relatively high efficiencies has provided data complementary to that obtained from beam wall current monitors and from various x-ray probes and other electrical probes. The optical image sensor consists of a gated, intensified television system. The gate pulse of the image intensifier can be appropriately delayed to give frames that are time-positioned from the head to the tail of the beam with a minimum gate time of 5-ns. The spatial correlation of the time frames from pulse to pulse is very good for a stable electron beam; however, when instabilities do occur, it is difficult to properly assess the spatial composition of the head and the tail of the beam on a pulse-to-pulse basis. Multiple gating within a pulse duration becomes desirable but cannot be performed because the recycle time (20-ms) of the TV system is much longer than the beam pulse. For this reason we have developed an optical-loop framing technique that will allow the recording of two frames within one pulse duration with our present gated/intensified TV system.

34005 (UCRL—90886) **TV-acquired optical diagnostics systems on ATA.** Kalibjian, R.; Chong, Y.P.; Cornish, J.P.; Jackson, C.H.; Fessenden, T.J. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 6p. (CONF-8406133—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013335.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

The purpose of this paper is to report on optical system developments on the ATA and their applications to ATA beam characterization. Television (TV)-acquired optical diagnostics data provide spatial and temporal properties of the ATA beam that complements recorded information from other types of sensors, such as, beam-wall current monitors, x-ray probes, and rf probes. The ATA beam operates: (1) in the normal mode at 50-MeV, 10-kA at a 1-Hz

rate; and (2) in the 1-KHz burst mode (for 10-pulses) at a 0.5 Hz rate. The beam has a 70-ns pulse width in vacuum propagation; however, beam-head erosion will occur in atmospheric propagation, thus limiting the pulse width to less than 50-ns. Various optical systems are used for ATA diagnostics. Optical-imaging provides a convenient measurement in a single pulse of the 2-dimensional profile of the beam intensity. It can also provide multiple 2-D framing in a single pulse. In some studies it may be desirable to study optical events with temporal resolution less than 100-ps with 1-dimensional streak cameras. Spatially integrated data from phototube cameras can also be used for background measurement applications as well as for single pixel monitoring. The optical line-of-sight (LOS) configurations have been made versatile to accommodate a large number of options for the various optical systems.

34006 **High frequency free-electron laser results.** Boyer, K.; Brau, C.A.; Newman, B.E.; Stein, W.E.; Warren, R.W.; Winston, J.G.; Young, L.M. (Chem. Division Univ. of California, Los Alamos Nat'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3076-3077(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

By looking at the free-electron laser as a particle accelerator working backwards, Morton realized that the techniques used to accelerate particles could be used to improve the performance of free-electron lasers. In particular, he predicted the capture of electrons in "stable-phase" regions, or "buckets" in the electron phase space, and proposed that by decelerating the buckets, the trapped electrons could be decelerated to extract significant amounts of their energy as optical radiation. In fact, since electrons not trapped in the stable regions are forever excluded from them--at least in the adiabatic approximation--displacement techniques could also be used to accelerate or decelerate electrons in a free-electron laser. This paper explains the principle behind "phase-displacement" acceleration and details an experiment carried out with a 20-MeV electron beam to test these predictions. Results obtained with a tapered-wiggler free-electron laser demonstrate the concepts proposed by Morton for enhanced efficiency. They show deceleration of electrons by as much as 7% and extraction of more than 3% of the total electron-beam energy as laser energy when the laser is operated as an amplifier. The experiment is presently being reconfigured to examine its performance as a laser oscillator.

34007 **Polarization preservation in the AGS.** Ratner, L.G. (Accelerator Dep.'t Brookhaven Nat.'l Lab., Assoc. Universities, Inc.). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2690-2692(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The successful operation of a high energy polarized beam at the Argonne Zero Gradient Synchrotron with the concommitant development of depolarizing resonance correction techniques has led to the present project of commissioning such a beam at the Brookhaven AGS. A description of the project was presented at the 1981 National Accelerator Conference. The current paper presents a more detailed description of how Brookhaven personnel plan to preserve the polarization during acceleration and how they intend to tune through some 50 resonances and reach their goal of a 26 GeV polarized proton beam with greater than 60% polarization. Some aspects of their resonance correction techniques are to cross resonances by fast passage and not rely on spin-flip; to use the slow AGS tune shifting quadrupoles to avoid hitting integer or half-integer resonances at v = 9.0 and 8.5; and to pulse the ring sextupoles in order to flatten the vertical tune profile and keep the total tune shift constant as a function of radius. They are also prepared to use a compensating horizontal (v /SUB x/) shift during the correction time should this prove necessary.

34008 **SRA: a new ion accelerator scheme.** Choe, J.Y.; Uhm, H.S. (Naval Surface Weapons Cntr., White Oak, Silver Spring, Maryland 20910). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3174-3176(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The space-charge resonance accelerator consists of a relativistic electron beam propagating through a dielectric loaded drift tube. In a range of physical parameters, the phase velocity of a self-growing space-charge wave increases slowly from zero to a large beam velocity as it propagates into the downstream region, thereby trapping and accelerating ions with its electric field. The self-growing mechanism of the space-charge wave is a typical Cherenkov radiation. This paper presents schematics and calculation methods which describe the accelerator, its dynamics, and its fields.

34009 **Adjustable strength REC quadrupoles.** Gluckstern, R.L.; Holsinger, R.F. (Phys. Dept., Univ. of Maryland, College Park, Maryland 20742). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3326-3329(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The development of high field rare earth cobalt (REC) permanent magnet materials has led to the development of rings which produce high field quadrupoles used primarily to focus charged particle beams. In a previous paper the authors demonstrated that adjustable magnets can be constructed by suitable rotation of the disks in a multi-disk quadrupole configuration. They used general symmetry considerations to show that a five disk singlet or four disk doublet could be adjusted to eliminate all coupling effects between the two transverse directions to lowest order in the transverse displacements. In this paper the authors obtain an expansion of all matrix elements up to and including terms of second order in the magnet strength. These results suggest a non-uniform choice of disk thicknesses which leads to a particularly simple prescription for the rotations. The accuracy of these suggestions is then confirmed by numerical computations which include the effects of known fringing fields from an REC ring. The authors conclude that fringing fields have almost no influence on the prescription of rotation angles, which eliminates coupling between the two transverse fields, and that they do not affect the focal strength of the total configurations in lowest order. The primary effect of the fringing fields is shown to be a shift in the principal planes as is the case for single quadrupole rings.

34010 **Undulators as sources of synchrotron radiation.** Krinsky, S. (Nat.'l Synchrotron Light Source, Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3078-3082(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

It is reasonable to expect that in the coming years the importance of wigglers and undulators to facilities with electron storage rings designed for and dedicated to synchrotron radiation research will increase. This paper discusses some of the properties of the radiation from these devices and some of the considerations which arise in their design and use in storage rings. The properties of wiggler radiation are describable in terms of the characteristics of synchrotron radiation from arc sources. These characteristics are well-known and well-documented. Undulator radiation, on the other hand, is less familiar, and thus receives the emphasis of this paper, which first reviews the spectral properties of the radiation and the complementary aspects of time-domain and frequency-domain analyses, then explores the brightness of the undulator source, and finally considers some limitations associated with operating an undulator in a storage ring.

34011 **Generation, focusing and transport of intense light ion beams.** Goldstein, S.A. (JAYCOR, Alexandria, VA). pp 417-421 of Energy storage, compression, and switching. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—).

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter describes the essentials of the ultra-high current density approach, the studies that have been performed to date and future possibilities. Most of the discussion is based on the recent advances made at the Naval Research Laboratory (NRL). The origi-

nal studies at NRL have resulted from the experimental and theoretical studies of the pinch phenomenon in high aspect ratio diodes.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 33992, 33994, 33995, 33996, 34001, 34109, 34110, 34140, 34573, 34946, 34966

34012 **(AD-A—137447/9) Modified betatron accelerator experiment. Final report 12 Jan 81-10 Dec 82.** Mako, F.M. (JAYCOR, Alexandria, VA (USA)). 6 Jan 1984. 205p. NTIS, PC A10/MF A01.

Contents: A free electron laser driven by a long pulse induction linac; special focus program advanced accelerator modified betatron design review coil design; external injection into a high current modified betatron accelerator; electron drift in a linear magnetic wiggler with an axial guide field; a broadband high power millimeter to centimeter spectrometer; electron drift in a linear magnetic wiggler with an axial guide field; numerical simulation of high energy light ion beam flow through a foilless diode; and high current, high voltage accelerators as free-electron lasers drivers.

34013 **(BNL—34812) New ion sources for nuclear structure studies at the TRISTAN facility.** Gill, R.L.; Piotrowski, A. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 8p. (CONF-840530—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013145.

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

TRISTAN is an on-line isotope separator (ISOL) facility located at Brookhaven National Laboratory's High Flux Beam Reactor. Short-lived neutron-rich nuclei, far from stability, are produced by thermal neutron fission of ^{235}U. These nuclei can be studied using facilities at the five available beam lines. These facilities include: a 4-detector angular correlation system, a delayed neutron spectroscopy facility, a conversion electron detector, a colinear fast beam dye laser system and a superconducting magnet for g-factor measurements. Ion sources of the surface ionization, negative surface ionization, thermal, FEBIAD, and plasma types are used to provide high yields over a wide range of elments for experiments at the available detector stations.

34014 **(CONF-8404170—1) Rare particles.** Kutschera, W. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013439.

From 3. international symposium on acceleration mass; Zurich, Switzerland (10 Apr 1984).

The use of Accelerator Mass Spectrometry (AMS) to search for hypothetical particles and known particles of rare processes is discussed. The hypothetical particles considered include fractionally charged particles, anomalously heavy isotopes, and superheavy elements. The known particles produced in rare processes discussed include doubly-charged negative ions, counting neutrino-produced atoms in detectors for solar neutrino detection, and the spontaneous emission of ^{14}C from ^{223}Ra. 35 references. (WHK)

34015 **(DESY-L-Trans—284) Secondary radiation field measurements in a steel block absorbing 69 GeV/c proton beams.** Volynchikov, A.I.; Getmanov, V.B.; Kuznetsov, A.A.; Krupnyi, G.I.; Lukanin, V.S.; Rastsvetalov, Y.N.; Tatarenko, V.M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751489.

Translated from Russian. Published as report IFVE--83-86.

Hadron fluences have been measured under deep penetration conditions within the energy range from thermal neutrons to 20 MeV by means of activation detectors inside a steel block absorbing narrow 69 GeV/c proton beams.

34016 **(DOE/ER/40017—7) Parity violating weak neutral current effects in elastic e-^{12}C scattering. Progress report, January 1, 1983-April 15, 1984.** Lubell, M.S. (City Coll., New York (USA)). 21 Apr 1984. Contract AC02-81ER40017. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014095.

The polarized electron source, which was designed at Yale, features full compatibility with the MIT-Bates accelerator with an injection energy of 365 keV, matching time structures, a ~ 1% duty cycle, and peak beam intensities in the range of 5 to 50 mA peak current. The experimental method utilizes photoemission from a GaAs crystal prepared to have a negative electron affinity in an ultrahigh vacuum system with base pressures of 10^{-10} torr or below. A high power continuous wave krypton-ion laser in conjunction with electro-optical instrumentation to chop the beam and to allow random polarization reversal is used as a light source.

34017 **(DOE/SF/00515—T33) Stanford Linear Accelerator Center monthly report for May 1984.** (Stanford Linear Accelerator Center, CA (USA)). May 1984. Contract AC03-76SF00515. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013810.

Portions are illegible in microfiche products.

Operational activities for the month of May 1984 are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, PEP division developments, and publications for the month. (GHT)

34018 (INIS-mf—8365, pp 93) **Rebuncher in the 30° beam line 'BUBI'.** Rudolph, K.; Lenz, U.; Skorka, S.J. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34019 (INIS-mf—8365, pp 121-122) **Use of very small BCS-ionization chambers as beam monitors.** Mayer, W.; Kloeckner, M. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34020 (INIS-mf—8365, pp 96-101) **Polarized ion source.** Schiemenz, P.; Eckle, F.J.; Eckle, G.; Graw, G.; Schmid, R. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34021 (INIS-mf—8365, pp 109) **Large vacuum tank HEXE.** Czech, W.; Loebner, K.E.G.; Steinmayer, M.; Trinks, U.; Wilhelm, W. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34022 (INIS-mf—8365, pp 110-111) **Extraction system for SuSe.** Hinderer, G. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34023 (INIS-mf—8903, pp 191-194) **Behaviour of the virtual electron source of the Philips SL 75-10 linear accelerator.** Yudelev, M.; Tatcher, M.; Mandelzweig, Y.; Kuten, A. (Technion-Israel Inst. of Tech., Haifa). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34024 (INIS-SU—221, pp 3-6) **Kharkov 2 GeV linac exploitation and modernization results in 1981-1982 years.** Antipov, K.I.; Artemov, V.I.; Demidov, N.V. (and others). 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

Some up-dated features of the 2 GeV linac systems, changes in beam parameters and new operating modes are described. The beam absorber design and biological shielding are modernized; a new injector with a removable source is installed; the synchronization system allowing to realize the operating mode at two frequencies of 100 and 50 Hz simultaneously is up-dated; the waveguide line seals are replaced. Using the modernized units the 53 mA pulse current is obtained at the accelerator output at 1450 MeV energy and 1.6 μs pulse duration. In view of expanding the scope of experiments on physics of crystals a new mode with low divergence and intensity Up to (1-2)x10^{-10} A is worked out. The reliability factors and effective accelerator time are presented.

34025 (INIS-SU—221, pp 55) **Present state of the 300 MeV electron linear accelerator LUEh-300.** Ajzatskij, N.I.; Ivanov, G.M.; Zubov, E.A.; Kondratenko, V.V.; Kurilko, V.I.; Makhnenko, L.A.; Ryabka, P.M.; Salij, L.D. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34026 (INIS-SU—221, pp 55) **"EhLIUS"-complex of linear electron accelerators in the Kharkov University.** Afanas'ev, V.D.; Zalyubovskij, I.I.; Rudychev, V.G.; Ushakov, V.I.; Chugunov, V.P.; Chkalov, I.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34027 (INIS-SU—221, pp 56) **Design of the radiofrequency power supply system for the LUE-120-ITs high-current electron linear accelerator.** Vetkin, V.A.; Vladimirtsov, M.B.; Gorshkov, E.P. (and others). 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34028 (INIS-SU—221, pp 57) **Electron beam buncher with an insulated resonator.** Abramenko, N.I.; Gavrilov, N.M.; Gromov, E.V.; Nesterovich, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34029 (INIS-SU—221, pp 57) **Tunable waveguide of a linear accelerator bunching section.** Azippo, V.A.; Ivanov, G.M.; Makhnenko, L.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34030 (INIS-SU—221, pp 58) **Unit for thyratron firing.** Borzhkovskij, V.F.; Kostanets, Yu.V.; Mukhachev, N.K.; Stervoedov, N.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34031 (INIS-SU—221, pp 58) **Improvement of electron beam energy spectra of the LUEh 2 GeV linear accelerator.** Buslovskij, S.F.; Gladkikh, M.A.; Krivchikov, V.P. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34032 (INIS-SU—221, pp 58-59) **Present status and reconstruction of the LUEh-25 electron linac.** Vajner, E.A.; Maksimova, O.A.; Ponomarev, V.N.; Filin, L.N.; Belousov, A.V.; Smirnov, V.L.; Shchepin, Yu.P. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34033 (INIS-SU—221, pp 59) **Electron linac with wide-range control of parameters - the main installation of a radiation-accelerating facility.** Vikulov, V.F.; Gubanov, A.V.; Sushinin, Yu.V.; Shal'nov, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34034 (INIS-SU—221, pp 59) **Operation experience of the REhLUS portable standing wave electron linacs.** Vikulov, V.F.; Zavadtsev, A.A.; Zverev, B.V.; Motyagin, A.I.; Nechaev, N.N.; Ruzin, V.V.; Smirnov, I.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34035 (INIS-SU—221, pp 59-60) **Possibility of intense pion beam production at the LU-2 GeV accelerator.** Vishnyakov, V.A.; Maslov, N.I.; Pugachev, G.D.; Khajfets, M.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34036 (INIS-SU—221, pp 61) **To the choice of heat-exchange surfaces of accelerating structure elements with a high-level of HF losses in a metal.** Ganzha, N.G.; Pavlovskij, V.G.; Ponomarenko, V.I.; Dajna, I.D.; Busygin, D.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34037 (INIS-SU—221, pp 62) **Excitation of supplementary oscillations in a multiresonator klystron.** Dovbnya, A.N.; Repalov, N.S.; Tur, Yu.D. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34038 (INIS-SU—221, pp 62) **Electron linac klystron efficiency increase at the expense of focusing field profile optimization.** Dovbnya, A.N.; Repalov, N.S.; Tur, Yu.D. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34039 (INIS-SU—221, pp 63) **Accelerating structures with transversal rods for small-sized electron linacs.** Zavadtsev, A.A.; Zverev, B.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34040 (INIS-SU—221, pp 63) **Electric strength of the accelerating structures of small-sized standing wave electron linacs.** Zavadtsev, A.A.; Zverev, B.V.; Sobenin, N.P. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34041 (INIS-SU—221, pp 63-64) **Standing wave accelerating systems on the base of multibeam structures.** Zverev, B.V.; Shilov, V.K. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34042 (INIS-SU—221, pp 64) **HF-system of a two-sectional standing wave acceleratar.** Kalyuzhny , V.E.; Shilov, V.K. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34043 (INIS-SU—221, pp 64) **Increase of electron beam intensity on the LUEh-40 in ector.** Kramskoj, G.D.; Fursov, G.L. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34044 (INIS-SU—221, pp 65) **Device for capacitive storage voltage stabilization.** Logvin, V.V.; Gusev, E.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34045 (INIS-SU—221, pp 65) **High-voltage nanosecond pulse ferpithyristor generators.** Meshkov, A.N.; Shishko, V.I.; Eremin, S.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34046 (INIS-SU—221, pp 66) **Development of the modulator of an electron linac three-electrode gun.** Moiseenko, B.I.; Protasyuk, G.N.; Uvarov, V.L. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34047 (INIS-SU—221, pp 66) **Small-sized electron and ion linear resonator accelerators on the base of self-excited oscillators.** Papasyuk, V.S.; Samoshenkov, YU.K.; Simanovskij, M.F. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34048 (INIS-SU—221, pp 67) **Power capacitive connection in HF linear accelerators on the base of self-excited oscillators.** Samoshenkov, Yu.K.; Simanovskij, M.F. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34049 (INIS-SU—221, pp 67-68) **Axial-symmetric resonator synthesis according to a given accelerating electric field axial distribution.** Solomakhin, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34050 (INIS-SU—221, pp 68) **Focusing system of a low-energy electron linac with a wide-range control of beam parameters.** Sushnin, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34051 (INIS-SU—221, pp 68-69) **Standing wave electron linac with proper HF-field focusing.** Filatov, A.N.; Shilov, V.K. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34052 (INIS-SU—221, pp 69) **U-30 electron linac operating characteristics.** Shchedrin, I.S. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34053 (INIS-SU—221, pp 70) **To the problem of a wave-type transformer effecting electron beam acceleration and bunching in an electron linac injector section.** Ajzatskij, N.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34054 (INIS-SU—221, pp 70) **Coaxial type resonator current load.** Ajzatskij, N.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34055 (INIS-SU—221, pp 73) **Two-frequency electron linac with a beam radiation field energy storage.** Bogdanovich, Yu.B.; Ignat'ev, A.P.; Ostanin, V.A.; Shal'nov, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34056 (INIS-SU—221, pp 73) **Energy characteristics of an electron linac with storage in the HF power system.** Bogdanovich, B.Yu.; Senyukov, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34057 (INIS-SU—221, pp 74) **Optimization of the electrodynamic characteristics of axially symmetric resonators and waveguides for linacs.** Bukharin, V.L.; Tret'yakov, A.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34058 (INIS-SU—221, pp 75) **Methods for the analysis of transients in the accelerating system of induction linacs.** Varlamov, N.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34059 (INIS-SU—221, pp 76-77) **Optimization of the LUEh-15-15000D accelerator focusing system.** Izotov, A.N.; Miroshnichenko, A.L.; Petrov, V.F.; Ryabtsov, A.V.; Tronov, B.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34060 (INIS-SU—221, pp 78) **Accelerating resonator calculation by the series method.** Orlov, A.K.; Skrydlyak, I.S. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34061 (INIS-SU—221, pp 79) **Dispersion properties of a cylindrical H-resonator loaded with a ferrite sphere.** Popov, V.A.; Cherkasova, K.P.; Khizhnyak, N.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34062 (INIS-SU—221, pp 81) **Current loaded resonator with supplying waveguide.** Shkol'nikov, Eh.Ya. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34063 (INIS-SU—221, pp 81) **Rigorous mathematical models of accelerating structure resonance cells.** Yashina, N.P. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34064 (INIS-SU—221, pp 82) **Measuring currents of colliding charged particle beams.** Alekseev, L.K.; Vikulov, V.F.; Garmash, A.G.; Glazov, A.I.; Li, Eh.A.; Murin, V.Yu. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

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34065 (INIS-SU—221, pp 82) **System for measuring beam position on the base of resonator transducers.** Alekseev, L.K.; Garmash, A.G.; Glazov, A.I.; Li, Eh.A.; Murin, V.Yu. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34066 (INIS-SU—221, pp 62) **Measuring the parameters of the LU-2 GeV accelerator beams.** Artemov, V.I.; Dem'yanenko, G.K.; Mel'nichenko, V.V.; Peev, F.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

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34067 (INIS-SU—221, pp 83) **Magnetostriction monitor of current density distribuition in a pulsed accelerated particle beam.** Blazhevich, S.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34068 (INIS-SU—221, pp 83) **Unit for synchronization of linear accelerator pulsed system triggering.** Borzhkovskij, V.F.; Kostenets, Yu.V.; Stervoedov, K.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34069 (INIS-SU—221, pp 84) **Measuring an electron beam profile and centre of gravity coordinates by an acoustic monitor.** Vajner, E.A.; Filin, L.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

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34071 (INIS-SU—221, pp 84-85) **High-frequency structures for excitation of an electro-optical converter of the picosecond linear accelerator electron beam parameters.** Vikulov, V.F.; Garmash, A.G.; Solov'ev, N.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34072 (INIS-SU—221, pp 85) **Application of a charge-coupled matrice for determination of a charged particle beam profile.** Vishnevskij, A.M.; Ku bida, R.P.; Rekukha, N.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34073 (INIS-SU—221, pp 85) **Control and stabilization of the accelerator temperature state and the on-line system for its provision.** Ganzha, N.G.; Pavlovskij, V.G.; Medvedev, G.I.; Khizhnyak, N.A.; Skoromnyj, G.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34074 (INIS-SU—221, pp 85-86) **Systems for measuring beam parameters in the LUEh-120ITs high-current injector subsystems of the EhKU-6 synchrotron on-line control system.** Gerasimov, V.P.; Grachev, V.F.; Ol'khovikov, L.V.; Saksaganskaya, O.S.; Skosarev, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34075 (INIS-SU—221, pp 86) **Linear accelerator injector control system.** Gritsyna, O.Ya.; Drugakov, A.N.; Kiselev, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

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34076 (INIS-SU—221, pp 86) **Software for the injector on-line control system.** Godnev, V.V.; Gritsyna, O.Ya.; Zamanskij, G.B.; Kiselev, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34077 (INIS-SU—221, pp 87) **On-line system for determination of the optimum irradiation conditions for the irradiation-accelerator benchmark.** Gubanov, A.V.; Mel'nikov, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34078 (INIS-SU—221, pp 87) **On-line control of multisection accelerating cell parameters.** Gurin, V.A.; Dem'yanova, A.N.; Mel'nichenko, V.V.; Savchenko, A.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34079 (INIS-SU—221, pp 88) **LU-2 GeV electron transport channel protection from beam damage.** Demidov, N.V.; Dem'yanenko, G.K.; Mel'nichenko, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34080 (INIS-SU—221, pp 88) **Synchronizer for the LU-2 GeV accelerator.** Demidov, N.V.; Dem'yanenko, G.K.; Martynenko, V.A.; Momot, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34081 (INIS-SU—221, pp 88-89) **Information and measuring system for the FAKEL linac.** Zharkov, V.A.; Kazantsev, V.I.; Rybin, V.M.; Tsyplyakov, A.P.; Petrenko, V.V.; Shakhov, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34082 (INIS-SU—221, pp 89) **Instrument for measuring the resonator eigenfrequencies.** Krutikhin, S.A.; Kurkin, G.Ya. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34083 (INIS-SU—221, pp 90) **Operational characteristics of the systems for electrophysical equipment thermostatting according to the SART scheme.** Pavlovskij, V.G.; Ganzha, N.G.; Medvedev, G.I.; Khizhnyak, N.A.; Skoromnyj, G.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34084 (INIS-SU—221, pp 90) **Functional problems solved in the SIRIUS electron synchrotron on-line control system.** Pasechnik, Yu.I.; Sidorenko, S.P.; Ostrast', M.S.; Neelov, S.M.; Lashchuk, I.A.; Krasnonosen'kikh, P.P.; Kochegurov, V.A.; Eponeshnikov, V.N. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34085 (INIS-SU—221, pp 90-91) **System for the SIRIUS synchrotron operation efficiency evaluation in the channeling experiments.** Tarasov, V.M.; Kas'yanova, L.P.; Potylitsyn, A.P.; Tomchakov, V.K. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34086 (INIS-SU—221, pp 91) **Scanning NMR magnetometer in the system of the LU-2 GeV accelerator beam energy parameter measurement.** Tatanov, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34087 (INIS-SU—221, pp 91) **Secondary electronic converters of charged particle accelerated beam time structure.** Tron', A.M. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—Po.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34088 (INIS-SU—221, pp 93) **Calculation of tolerances in accelerating structures.** Alisherov, A.; Ovsyannikov, D.A.; Papkovich, V.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34089 (INIS-SU—221, pp 94) **System for measuring linac proton beam energy spectra during a single pulse.** Burgov, K.N.; Kujbida, R.P.; Sharakin, O.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34090 (INIS-SU—221, pp 95) **Plasma-filled double diode.** Bystritskij, V.M.; Volkov, S.N.; Didenko, A.N.; Petrov, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34091 (INIS-SU—221, pp 95) **System for stabilizing ion beam intensity in an injector of the meson factory linac.** Vasil'ev, V.S.; Gerasimov, V.P.; Gordin, V.I.; Peshin, A.V.; Skosarev, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34092 (INIS-SU—221, pp 96) **MSKUI-450 small-sized combined cascade ion accelerator.** Venevtsev, I.T.; Ponomarchuk, E.I.; Skoromnyj, G.M.; Shelepko, V.P. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34093 **(INIS-SU—221, pp 96) Application of nuclear photoemulsion for magnet spectrometer calibration.** Gusev, E.V.; Demchenko, P.A.; Koval'chuk, I.K.; Shchulika, N.G. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34094 **(LA—10051-MS) Need for an intense polarized source at LAMPF. Report on a workshop held at Los Alamos, November 9, 1983.** McNaughton, M.W.; Silbar, R.R.; van Dyck, O.B. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014138.

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We report on a workshop to consider the need for an intense polarized source at LAMPF. The primary justification for such a source comes from the nucleon-nucleon program; neutron-proton scattering is seriously underdetermined and cannot be satisfactorily completed without such an intense source. Further justification comes from nuclear (vector n,p) and (vector p, vector n) reactions, as well as from traditional nuclear physics at the LAMPF high resolution spectrometer. We recommend that a source capable of providing a few μA beam on target be built as soon as possible.

34095 **(LBL—17068) Progress on the LBL ECR heavy ion source.** Clark, D.J.; Jongen, Y.; Lyneis, C.M. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 6p. (CONF-8404143—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013394.

From 10. international conference on cyclotrons and their applications; East Lansing, MI, USA (30 Apr 1984).

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The LBL ECR ion source, which began test operation in January 1984, has already produced a variety of high charge state heavy ion beams of sufficient intensity for cyclotron operation, although actual use must wait for completion of the beam transport system. The source has produced 40 μA of O^{6+}, 2 μA of O^{7+}, 40 μA of Ar^{8+}, and 0.20 μA of Ar^{12+}. The source development has centered on optimizing source performance with modifications and parameter tuning. Future plans include construction of an $SmCo_5$ octupole structure, and testing of solid feed techniques. The construction of the beam transport line and calculations on center region geometry for heavy ion axial injection into the 88-Inch Cyclotron are also underway.

34096 **(SLAC/AP—23) Coating of the SLAC klystron windows.** Krienen, F. (Stanford Linear Accelerator Center, CA (USA)). 23 May 1984. Contract AC03-76SF00515. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013508.

Secondary emission is not likely to be suppressed in thin films. Accumulated charges leak away with two time constants. The fast time constant should be short compared to the pulse duration, and the slow time constant should be short compared to the time between pulses. The Joule heating may be prohibitive in reaching adequate charge removal. The joule heating may be reduced by films which conduct little in the direction of the electric field and much better in the perpendicular direction.

34097 **(SLAC-CN—271) SLC intergirder quad vibrations.** McLagan, K. (Stanford Linear Accelerator Center, CA (USA)). 25 Jun 1984. Contract AC03-76SF00515. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013502.

This report concerns recent measurements of the x, y and z vibrational motion of the quadrupole focusing magnets mounted between 40' girder assemblies in Sector 5. The amplitudes of their vibration were of particular concern, and these were measured in the presence of several different disturbances.

34098 **(SLAC-PUB—3331) Trends in accelerator control systems.** Crowley-Milling, M.C. (Stanford Linear Accelerator Center, CA (USA)). Apr 1984. Contract AC03-76SF00515. 5p. (CONF-840529—38). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012511.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

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Over the years, we have seen a revolution in control systems that has followed the ever decreasing cost of computer power and memory. It started with the data gathering, when people distrusted the computer to perform control actions correctly, through the stage of using a computer to perform control actions correctly, through the stage of using a computer system to provide a convenient remote look and adjust facility, to the present day, when more and more emphasis is being placed on using a computer system to simulate or model all or parts of the accelerator, feed in the required performance and calling for the computers to set the various parameters and then measure the actual performance, with iteration if necessary. The progress that has been made in the fields of architecture, communications, computers, interface, software design and operator interface is reviewed.

34099 **(BNL-tr—1032) New pulser for principal PO power.** Coudert, G. (Brookhaven National Lab., Upton, NY (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 1984. Contract AC02-76CH00016. Translation of PS/PO/Note 82-9, September 1982. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013349.

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The pulser of the principal power of the PS is the unit that makes it possible to generate the reference function of the voltage of the principal magnet. This function depends on time and on the magnetic field of the magnet. It also generates various synchronization and reference pulses.

34100 **PHERMEX electron gun development.** Builta, L.A.; Elliott, J.C.; Moir, D.C.; Starke, T.P.; Vecere, C.A. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2728-2730(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The PHERMEX facility is a 50 MHz standing wave linear accelerator which injects, accelerates, and transports electrons to a tungsten target where Bremsstrahlung x-rays are generated for flash radiography of hydrodynamic systems. The goal of the electron gun program is to generate and transport a 200 ns, 1 MeV, 1 kA beam into the first PHERMEX accelerating cavity. The standard gun is operated at a pulse voltage of 550 keV; this limit is determined by internal breakdown in the vacuum insulator. This insulator has been redesigned and the gun has been pulsed at 750 keV without breakdown. At present, the current output is not limited by voltage but by a phenomenon called pulse shortening, which occurs at a voltage of ca. 650 keV. This paper discusses the results of an investigation into this phenomenon, describes the development program, design, and experimental arrangement of the injector, and presents an array of measured performance data.

34101 **Status of BESSY, an 800-MeV storage ring dedicated to synchrotron radiation.** Egan-Krieger, G.V.; Einfeld, D.; Hoberg, H.G.; Klotz, W.D.; Lehr, H.; Maier, R.; Martin, M.; Mulhaupt, G.; Richter, R.; Schulz, L. (Berliner Elektronenspeicherring-Gesellschaft fur Synchrotronstrahlung m.b.H. (BESSY) 1000 Berlin (West) 33, Lentzeallee 100 CNTRY: DD). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3094-3096(Aug 1983).

BESSY is a national dedicated source for synchrotron radiation situated in West Berlin. This facility includes an 800 MeV electron storage ring, an 800 MeV separated function injector-synchrotron, and a 20 MeV preinjector-microtron. The storage ring is available for three classes of user groups: basic and applied research

performed by universities and research institutions, industrial development in the field of x-ray lithography, and radiometry. The critical wavelength for BESSY was chosen as 2 nm. This corresponds to a maximum field strength of 1.5 T in the bending magnets at 800 MeV and a bending radius of 1.78 m. By this choice of spectral range, which covers the infrared, VUV, and soft x-ray region up to 5 KeV photon energies, BESSY meets the demands of x-ray lithography and complements the hard x-ray laboratory HASYLAB at DESY. The two laboratories serve as national centers for synchrotron radiation research. In order to meet the demands of users in the various fields, a magnet lattice with four fold supersymmetry was chosen, with the flexibility of permitting operation of the storage ring with different magnet optics. The lattice consist of eight quadrupoles and three 30° bending magnets per cell. User operation started in July 1982. Nine monochromators out of a projected sixteen have been commissioned and turned over to user availability. Of the available six beam lines in the lithography laboratory two were commissioned in September 1982 and fitted with exposure chambers. This paper discusses the optics and dynamics of BESSY determined so far on the basis of this operating experience.

34102 **A cusped field H^- ion source for LAMPF.** York, R.L.; Stevens, R.R. Jr. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2705-2707(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The addition of the Proton Storage Ring (PSR) to LAMPF requires the development of a more intense H^- ion source. The goals of this development program are to produce a beam of sufficient quality to match the acceptance of the accelerator and of sufficient intensity and duty factor to satisfy PSR operation as well as existing LAMPF requirements. The ion source concept best suited to these demands is the multi-cusp negative ion source being developed at LBL. The H^- ion source development was carried out on the high-voltage test stand in the LAMPF injector complex. The test stand, upgraded for the project, provides both unanalyzed and mass-analyzed beams to appropriate emittance scanning stations. Beam currents are measured using both beam current toroids and biased Faraday cups in both sections of the transport line. The emittance data are processed by the SEL 840 control computer at LAMPF. Ion source testing has been carried out using the extraction optics originally developed for the LAMPF duoplasmatron. Optics questions are being addressed by the plasma simulation code SNOW developed at Sandia. The accelerating column design will seek to minimize the divergence of the extracted beam and the predictions from SNOW will be tested on the stand with actual H^- beams.

34103 **Superconducting materials for particle accelerator magnets.** Larbalestier, D.C. (Applied Superconductivity Center, Univ. of Wisconsin, Madison, Wisconsin 53706). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3299-3303(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Present accelerator designs are clustered around a field of 5 Tesla with several future studies looking at the 8-to-10 Tesla range. There has also been some recent interest in low-field iron-dominated dipoles in which the superconductor will see a field of about 2 Tesla. The demands of this present range of interest can still be met, with the upper limit at about 10 Tesla, by the use of Nb-Ti (or Nb-Ti-Ta) or Nb_3Sn. Both of these conductors are available in multifilamentary form from industrial sources and are suitable for accelerator magnets. The upper critical field and transition temperature of both types of composite cover the foreseeable range of demand for such magnets. There is no magical new composite on the horizon that is likely to replace Nb-Ti or Nb_3Sn. One class of materials which has a potentially exciting prospect is that of the ternary molybdenum sulfides. These can have an upper critical field of greater than 50 T, which extends their superconductivity into field ranges unattainable with A15 compounds; the two drawbacks to such materials, however, are the amount of development needed to produce superconductors from them with useful current densities and the fact that it does not appear that they would offer any features not already possessed by Nb-Ti or Nb_3Sn in the field range presently of interest to accelerator designers. Using this pragmatic approach, this paper addresses these and other superconducting composites in terms of their fabrication, their testing, the measurement aspects of their critical current densities, and other properties which are pertinent to their selection for particle accelerator magnet use.

34104 **The present status of the Daresbury Nuclear Structure Facility.** Voss, R.G.P. (Science and Engineering Research Council, Daresbury Lab., Daresbury, Warrington WA4 4AD). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2680-2684(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

This paper covers the development of the Daresbury Nuclear Structure Facility from 1973 to the present. At that point, the design study had been completed for a tandem to operate initially at 20 MeV and to undergo eventual upgrading to 30 MeV, and a fully costed proposal had been submitted to the Science Research Council. In 1974, planning permission was obtained, and full financial authorization was given to proceed to the 20 MeV stage. The design of the accelerator fell into two areas. The first of these covered those aspects of the design based on known techniques and calculable properties such as the ion beam optics and dynamics and associated equipment. The second area dealt with the less certain design aspects: the behavior of insulators, their protection, the properties of charging mechanisms, accelerator tubes and vacuum systems, and the operation of a computerized control system in a hostile high-voltage environment. This paper describes the research programs and the pilot and test equipment employed to overcome these uncertainties and goes on to discuss a variety of experiments conducted at the present facility.

34105 **Accelerator development at Bates.** Sargent, C.P. (MIT Bates Linear Accelerator, P.O. Box 846 Middleton, MA 01949-2846). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3262-3266(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The past year has seen the completion of a major expansion of the Bates Accelerator Laboratory. A second experimental hall, South Hall, and several magnetic spectrometers have been constructed. The accelerator's maximum energy has been raised from 400 to 750 MeV by means of beam recirculation. A current two-year project for the fabrication of an additional RF transmitter plus a 30% increase in RF peak power capability will increase energy further to ca. 1 GeV. During the same period pulse-to-pulse beam sharing between the high-resolution spectrometer area and South Hall will become available. In January 1981 the Laboratory submitted their "Proposal for a Long-Range Expansion Program" to DOE-NSF. The proposed development consists of three stages. Stage I calls for the addition of a pulse stretcher ring to furnish a CW beam to the South Hall beam lines. Additional experimental space for internal target experiments and photon tagging research are also included. Stage II increases the accelerator energy to 2.1 GeV (at 140 microamps) by means of a five-pass head-to-tail recirculator. Stage III is, at this time, a plan rather than a proposal. It increases accelerator energy to 4 GeV by extending the accelerator length and power and adds another pulse stretcher ring and three new experimental areas for the higher energy work. This paper discusses each of these stages in detail and recommends their funding and scheduling.

34106 **Superconducting delay line for stochastic cooling filters.** Kuchnir, M.; McCarthy, J.D.; Pasquinelli, R.J. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3360-3362(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The stochastic cooling system of the antiproton source at Fermilab uses notch filters for reducing the feedback power at fre-

quencies corresponding to particles in the core. At the same time these filters assist in shaping the gain vs. momentum in the stack tail. These filters, therefore, must attenuate all the harmonics of the revolution frequency (629 kHz) in the operating frequency band (1-2 GHz). They require components providing delays of 1.59 microseconds with a minimum of attenuation and undesirable distortion in this passband. Transmission lines providing such delays are typically 328 m long, have a rather large diameter, and are fabricated from a high conductivity material to keep the attenuation sufficiently low. The use of superconductors allows a dramatic reduction in the diameter, total size, and cost of this component in spite of the added cryogenic requirements. The authors measured the performance of two such cables in order to demonstrate the feasibility of the superconducting cable-notch filter concept. The first cable is an 84 m long superconducting coax consisting of a solid Niobium inner conductor inside a teflon dielectric, a lead outer conductor, and an outer jacket of mylar tape. The second cable is a 1.0 km long coaxial line with an inner conductor of lead-plated copper wire, a FEP teflon dielectric, and an outer conductor of leadplated copper tape wrapped with mylar. This paper discusses the results of performance testing of both cables and assesses their compatibilities with notch filters.

4304 Storage Rings

34107 **(FERMILAB-Conf—84/29-THY) Coupled bunch instabilities in a p anti p collider.** Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 13p. (CONF-840275—9). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012704.

From Workshop on anti pp options for the SSC; Chicago, IL, USA (13 Feb 1984).

These notes summarize a small amount of work done during preparation of the Fermilab Dedicated Collider proposal last year. The basic problem is as follows: Consider a storage ring with k proton bunches and k antiproton bunches, where electrostatic deflection devices are used to separate the beams except at the collision points in the interaction regions. Then the normal betatron motions of the bunches become coupled not only by the usual beam-beam force at collision points, but also by the forces exerted in the close encounters as one bunch passes nearby another. The problem we pose is simply to determine necessary and sufficient conditions for stability, given a linear approximation to the forces and motions as well as an assumption of rigid (coherent) bunch motion. This problem-essentially one of coupled oscillators-has been studied before, and the main result here may be folklore. However, this author has had some trouble, as usual, in identifying it all from the literature. We hope that the formalism and results here may be of use in exploring this phenomenon in more generality.

34108 (INIS-SU—211, pp 3-5) **Reconstruction of the KFTI N-100 storage ring with increase of stored electron energy up to 160 MeV.** Kozin, V.P.; Markov, V.V.; Mocheshnikov, N.I.; Tolstoj, A.E. 1982. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI84780255.

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In Technique of physical experiment.

To increase the effectiveness of investigations into dynamics of injected and accumulated electron beams as well as to broaden the possibilities of applying synchrotron radiation in H-100 storage ring of KFTJ of the Ukranian Academy of Sciences, the energy of electrons has been increased from 100 MeV (according to the project) to 160 MeV. The analysis of experimental curves of magnetized quadrants and exact calculation of the magnetic circuit have shown that by way of increasing magnetic motive force of quadrants it is possible to increase the intensity of magnetic field to the level 1 to 1.1 Tl, which corresponds to the energy of circulating electrons 160 to 165 MeV. In the course of reconstruction the intensification of separate section of magnetic circuit of quadrants is made, the ajustment of the ring that of injection tract is performed, measurements of the main magnetic characteristic are made. The first control experiments on the accumulation of the beam of electrons with the energy of 70 MeV and the following adiabatic increase of energy up to 160 MeV have shown that losses of the circulating beam do not exceed 10%.

34109 (INIS-SU—221, pp 61-62) **VEPP-4 positron source linear accelerator injection system.** Grishanov, B.I.; Kuznetsov, G.I.; Ul'yanov, Yu.N.; Chibukov, Yu.Ya.; Yakovlev, V.P.; Yasnov, G.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34110 (INIS-SU—221, pp 62) **VEPP-4 positron source conversion system.** Dzyuba, V.A.; Klyuev, V.F.; Kozhemyakin, A.V.; Persov, B.Z.; Tayurskij, V.A.; Yasnov, G.I. 1983. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780353. (CONF-8306180—No.2(14)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

34111 **Photon factory: status of storage ring.** *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3130-3132(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The 2.5 GeV electron storage ring at the Photon Factory is a dedicated synchrotron radiation source. The magnet system, composed of 28 bending magnets and 58 quadrupoles, is capable of raising energy up to 3 GeV by ramping after the beam is stacked. Injection is carried out in the multi-turn scheme at pulse times as long as 1 microsecond, a revolution time of 624 nanoseconds, and a rate of 1 Hz. Four 500 MHz RF cavities are situated in the straight section. Each cell is rated to dissipate 30 kW of RF power from an RF source consisting of two 180 kW klystrons. Out of 24 possible exit ports for synchrotron radiation, seven beam lines are operational and two more are in preparation. Each line is split into three or four branch lines, to each of which an experimental station is attached. The first beam was stored at the design energy in March 1982. Experiments in synchrotron radiation were begun in June. A superconducting vertical wiggler of 5 T and a permanent magnet undulator were successfully brought into operation in February 1983. This paper assesses the design and operating experience of the storage ring over its lifetime.

44 INSTRUMENTATION

REFER ALSO TO CITATION(S) 34990

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 32764, 32767, 33222, 33885, 34014, 34564

34112 **(BNL—34839) Recent developments in thermoluminescence kinetics.** Levy, P.W. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 34p. (CONF-840290—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013226.

From National symposium on thermally stimulated luminescence and related phenomena; Ahmedabad, India (1 Feb 1984).

Thermoluminescence (TL) kinetics have been investigated that are more general than those described by the well known 1st and 2nd order kinetic equations. Single glow peak systems studied include the general one-trap kinetic expression from which the 1st and 2nd order kinetics re derived. Glow curves computed from this expression were regarded as data, and their properties determined by inspection and by fitting to the less general 1st and 2nd order kinetics. Often the computed glow curves are well fitted by the 1st and/or 2nd order kinetics over their upper 60 percent, but not in the wings. The best-fit determined kinetic parameters usually differ appreciably from those used to compute the data curves. The properties of the general one-trap kinetics are exemplified by measured glow curves from CaF_2:Mn. To describe systems with two or more

glow peaks, kinetics have been developed that appear to be the simplest possible extension of the general one-trap kinetic expression that describes the retrapping of thermally released charges on all traps present. Called interactive TL kinetics, its properties have also been studied by computing glow curves and determining their properties by inspection and fitting to 1st and 2nd order glow peaks. The interactive kinetic glow curves exhibit all of the properties mentioned above for single peak glow curves and, in addition, reproduce many experimentally determined features that are anomalous and/or not described by the usual 1st and 2nd order kinetics. Also, glow curves computer from the interactive kinetic equations for increasing initial trapped charge concentrations, i.e. increasing premeasurement doses, exhibit supralinearity. Thus the little understood supralinearity appears to be a natural property of TL systems described by intereactive kinetics.

34113 (DOE/ER/40048—89-L3) Photon detectors, E/sub γ/ = several MeV to 1 GeV. Bowman, D.; Snover, K. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1984. Contract AC06-81ER40048. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013826.

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Our ability to detect photons is crude compared to the efficiency and precision of techniques available for charged particles. This makes each advance in detector technology important; a factor of 2 improvement in resolution, timing or efficiency may make it possible to study a new class of phenomena or to find a new aspect of a familiar phenomenon. We discuss the properties of several types of instruments for the detection of photons of energy between several MeV and 1 GeV. Some of the instruments seem to be fully developed while others, while very interesting, are yet to be demonstrated.

34114 (EML—418) Theoretical and practical implications of the effects of temperature during irradiation and during pre- and post-irradiation storage on the response of thermoluminescence dosimeters. Gail de Planque, E. (USDOE Environmental Measurements Lab., New York). Jan 1984. 165p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84014120.

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Experiments have been conducted to determine the applicability of the Randall-Wilkins theory for describing the behavior of CaF_2:Mn thermoluminescence dosimeters (Harshaw TLD-400 chips). Results were obtained for four different conditions: irradiation followed by storage, irradiation after storage, irradiation both preceded and followed by storage, and continuous simultaneous irradiation and storage. The experiments were performed for storage intervals of approximately 1, 2, 3, 5, 6 and 7 days at five different storage temperatures: -25, +20, +65, +150 and +175°C. The results indicate fading that is described not by the Randall-Wilkins theory but rather as a linear function of the logarithm of the storage time. While the results suggest that the trapping efficiency is independent of temperature, they do demonstrate a small decrease in TL response with storage time prior to irradiation which is independent of temperature and time (>17 hours) and hence probably not dosimetric in origin but perhaps optically related. Glow curve analyses support the concept of a band of traps rather than a single trap. The overall results are compared to other data available in the literature most of which is for room-temperature storage. These data, for storage periods ranging from minutes to one year, can also be described as a linear function of the logarithm of the storage time and are remarkably consistent when uniformly normalized. Although peripheral experiments revealed problems associated with self-irradiation as well as a decline in sensitivity with use, the stability experiment results verify the highly favorable stability properties of CaF_2:Mn for widespread application.

34115 (EML—428) RADEX: an active monitor for continuous measurement of ^{222}Rn flux in soil. Watnick, S.; Latner, N.; Graveson, R.T. (USDOE Environmental Measurements Lab., New York). May 1984. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014122.

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A radon exhalation monitor, RADEX, was developed at the Environmental Measurements Laboratory. RADEX is an active radon monitor that continuously samples radon gas emanating from the soil. A hemispherical accumulator is placed on the soil and radon gas is drawn into the RADEX counter at a low, controlled flow rate. As ^{222}Rn decays, the resulting radon daughters are focused by an electrostatic field, deposited directly onto a semiconductor detector, and counted. RADEX's ability to detect rapid changes in radon exhalation is made possible by analyzing RaA alphas with fast decay times. The pulses produced by the radon daughters are integrated hourly and are recorded. This system can operate unattended for 1 week, at which time a desiccant column must be changed. Thus, RADEX allows one to observe and to record continuously the radon flux from the soil. 8 references, 10 figures, 1 table.

34116 (FRNC-TH—1430) First results obtained from the Cello liquid argon end cap calorimeters. Le Diberder, F. (Paris-7 Univ., 75 (France)). May 1981. 195p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84751561.

The Cello liquid argon calorimeter is presented in the first part of this thesis. The cryogenic system has to supply three cryostats filled with liquid argon: one cylindrical cryostat of 25 m^3 volume contains 2x8 separate modules; each of the two symmetric end cap cryostats contains two half cylindrical modules. Each module in the end cap part consists of 42 layers of lead strips interleaved with 43 full plates. The strips are alternatively vertical, horizontal and circular. In front of the lead calorimeter are 4 planes of copper foils glued on epoxy for dE/dx measurement. The electronics, signal processing and data acquisition system are described. In the second part, the performance and analysis of data measured by the end cap calorimeters are reported: study of Bhabha scattering $e^+e^- \rightarrow e^+e^-$; preliminary results obtained in two photon physics $e^+e^- \rightarrow e^+e^-\gamma\gamma \rightarrow e^+e^-X$.

34117 (FRNC-TH—1585) Contribution to the development of a primary standard for high energy neutron beams. Mancaux, M. (Toulouse-3 Univ., 31 (France)). Dec 1983. 1p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751571.

A tissue equivalent calorimeter, made of Shonka A-150 plastic, has been constructed in order to create a primary standard for high energy neutrons and to establish a calibration procedure for ionization chambers used in neutrontherapy. After a detailed description of the calorimeter and the associated measuring system, the preliminary tests are presented, in particular, the evolution of the response as a function of accumulated dose. The measurements of the total absorbed dose (n + γ) by calorimetry in a neutron beam, in order to determine chambers' calibration factors in terms of absorbed dose to A-150 plastic, have been performed at the Neutrontherapy Unit of the Centre Hospitalier Regional d'Orleans. The uncertainty in the determination of the total absorbed dose to the tissu equivalent material using the new procedure is 3% lower than that obtained with the usual procedure, derived from an exposure calibration.

34118 (GKSS—82/E/56) Comparative measurements between a Li-6 glass and a He-3 high-pressure gas scintillator. Priesmeyer, H.G.; Fischer, P.; Harz, U.; Soldner, B. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 16p. (CONF-820942—39). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751430.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

The He-3 high-pressure gas scintillation neutron detector commercially available as LND 800, has been compated to a Li-6 glass scintillator type NE 912. (n,γ) pulse height discrimination capabilities and neutron detection efficiencies have been determined. The objective of these measurements was to try to improve the Kiel Fast-Chopper TOF detector system by using a gasscintillator, which could cover the neutron beam geometry and by which gamma ray background contributions could be reduced. The time response always meets the requirements of a chopper experiment,

but the neutron detection efficiency of the Li-6 glasses now used had to be maintained.

34119 **(HAR—4903) Neutron time-of-flight data acquisition system.** Morris, D.V. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Oct 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780376.

A neutron time-of-flight scaler system is described for use with the Harwell Linac. The equipment is sufficiently versatile to be used with several types of computers although normally used with DEC PDP 11/45 and PDP 11/34. Using a combination of different input and memory boards most types of experiments can be accommodated. (author).

34120 **(IAEA-R—2549-F) Development of a prototype calorimeter for absorbed dose determination. Final report for the period 1 May 1980 - 31 December 1983.** Duftschmidt, K.E. (International Atomic Energy Agency, Vienna (Austria)). Dec 1983. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702040.

As the final report of a three-year project carried out in the IAEA dosimetry laboratory on 'Design and construction of a portable graphite calorimeter', the construction, mode of operation, testing and performances of a prototype and four production units are presented. Results of extensive testing, by measuring the absolute absorbed dose with different ^{60}Co sources, at the Seibersdorf Laboratory and the Hungarian National Office of Measures, Budapest, are given. Due to the improvements in the electronic circuitry, the introduction of a second core thermistor, and a new mode of operation under isothermic conditions, the sensitivity of the new apparatus was improved with one order of magnitude compared to the model started from, namely the one developed at the US National Bureau of Standards.

34121 (INIS-BR—120, pp 91) **Gaussian filter for nuclear spectroscopy using the dislocated form.** Obadia, I.J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

34122 (INIS-BR—120, pp 199-200) **Measurement of fissile target thickness by alpha spectrometry.** Aranda Amado Furieri, R.C. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

34123 (INIS-BR—120, pp 200) **Spectrometry of fast neutrons.** Silva, A.A. da (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

34124 (INIS-BR—120, pp 58-59) **Production of Geiger-Mueller detectors.** Costa, V.L. da; Auler, L.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

34125 (INIS-BR—120, pp 91-92) **Multichannel analyzers.** Soares, M. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

34126 (INIS-mf—8365, pp 120) **Simultaneous position determination of α-particles and fission products with parallel plate counters.** Bantel, M.; Duennweber, W.; Hering, W.; Nilges, M. 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34127 (INIS-mf—8365, pp 140) **LIZA, fit program for particle spectra.** Kader, H. 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34128 (INIS-mf—8365, pp 141-142) **Program for the defolding of two-dimensional gamma-spectra.** Kurfuerst, W. 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34129 (INIS-mf—8365, pp 118-119) **Electron/positron detector for the orange-β-spectrometer.** Berdermann, E.; Bosch, F.; Clemente, M.; Kemmer, J.; Kienle, P.; Koenig, W.; Kozhuharov, C.; Tsertos, H.; Wagner, W. [nd]. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

Published in summary form only.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

34130 (INIS-mf—8903, pp 74-74b) **Nuclear float. An accurate contact-free continuous level-gauge.** Paran, J.; Pasi, M.; Ankary, N.; Gabay, Y. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34131 **(INS-TL—143) New source exchange equipment of the INS iron-free β-ray spectrometer.** Kawakami, H.; Fujita, Y. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1982. 9p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702041.

The new beta-ray source exchange equipment has been developed for the INS beta-ray spectrometer. A beta-ray souce is confined under vacuum in the special container, and the equipment can exchange a beta-ray source without breaking the vacuum of the source container and the source chamber of the spectrometer. This report describes what it is, and how to exchange a beta-ray source with it.

34132 **(KFK—3596) Control program of the neutron four-circle-diffractometer P32 at the SILOE reactor/CEN Grenoble.** Guth, H.; Paulus, H.; Reimers, W.; Heger, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik 1). Sep 1983. 100p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751480.

The four-circle diffractometer P32 for elastic neutron scattering on single crystals was installed at the SILOE reactor/CEN Grenoble in 1981. The control program, presented here, is a new update of the former program versions used at the FR2 reactor/Kernforschungszentrum Karlsruhe. Important improvements concerning reliability and handling of the diffractometer are added.

34133 **(LAL-RT—83-14) Vertex detector of the UA2 experiment (a low mass self sustaining system of cylindrical multiwire proportional chambers).** Dialinas, M.; Forget, J.; Geoffroy, D.; Jean, P.; Vergand, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751565.

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The construction of the cylindrical proportional strip chambers of the UA2 vertex detector is reported. The mechanical design, the engineering and the effective realization are described in detail. Possible improvements for the construction of such chambers are also given.

34134 (PB—84-151885) Integral reaction rate measurements in ^{252}Cf and ^{235}U fission spectra. Final report. Lamaze, G.P.; McGarry, E.D.; Schima, F. (National Bureau of Standards, Washington, DC (USA)). 1983. 5p. Pub. in Proceedings of Nucl. Data Sci. Technol., Antwerp, Belgium, September 6-10, 1982.

In support of the light water reactor pressure vessel (LWR-PV) surveillance dosimetry program established by the U.S. Nuclear Regulatory Commission, the National Bureau of Standards is undertaking a series of measurements to provide a physical basis for neutron dosimetry standards. Reaction rate measurements have been made with both 252 Cf and 235U fission neutron fields. The following reactions have been measured through an activation technique: 115In(n,n') 58Ni(n,p) and 54Fe(n,p). The neutron emission rate of the 252Cf source has been measured with the MnSO4 bath technique, thus permitting a direct measure of the spectrum averaged integral cross section for Cf. The source strength of the 235U fission neutron field has been measured relative to the 252Cf neutron field using the 115In(n,n') reaction. All measurement of cross sections in the 235U fission field are therefore relative measurements.

34135 (PNL—5136) TACI: a code for interactive analysis of neutron data produced by a tissue equivalent proportional counter. Cummings, F.M. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 50p. (UC—32). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013922.

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The TEPC analysis code (TACI) is a computer program designed to analyze pulse height data generated by a tissue equivalent proportional counter (TEPC). It is written in HP BASIC and is for use on an HP-87XM personal computer. The theory of TEPC analysis upon which this code is based is summarized.

34136 (PNL-SA—10985) Results of testing and evaluating a health physics instrument performance standard. Kenoyer, J.L.; Swinth, K.L.; Kathren, R.L.; Fleming, D.M.; Selby, J.M.; Vallario, E.J.; Federline, M.V. (Pacific Northwest Lab., Richland, WA (USA); USDOE, Washington, DC; Nuclear Regulatory Commission, Washington, DC (USA)). Sep 1983. Contract AC06-76RL01830. 5p. (CONF-840512—11). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013252.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

This paper presents data taken during testing of health physics instrumentation that provides information for the evaluation of the applicability and practicality of the proposed ANSI standard (N42.17) and the determination of the degree of conformance of currently available instruments to the proposed standard. The instruments tested included ionization chambers, Geiger Mueller detectors, alpha survey meters, neutron dose equivalent survey meters, and air monitors. (ACR)

34137 (Y/DD—336) Design and use of a constant geometry system to measure activated indium foil in personnel security badges. Barclay, R.K. (Oak Ridge Y-12 Plant, TN (USA)). Jun 1984. Contract AC05-84OS21400. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013640.

A device for measuring the exposure rate from neutron-activated indium foil, under constant geometry, has been designed, constructed, and tested. The device is intended for use with the Juno ionization chambers, although it adapts to Victoreen CDV-700 and Victoreen 193 G-M instruments. Juno dose-response data for low (53 rad) and high (226 rad) doses were compiled and modeled. This model was compared to that assumed from the indium foil dose-response model in current use; plots of fitted and assumed models are congruent. An analysis of data from both Juno and CDV-700 instruments indicates that the constant geometry device may be used effectively to monitor the decay of In-116m. Tolerance limits for the Juno dose-response curve increase with time after activation, which results in diminished precision of dose estimates made by indium foil measurement. From the data collected in these experiments, the system appears to be most useful if activation is measured within 250 min after exposure. 5 references, 7 figures, 1 table.

34138 Neutron and gamma personnel dosemeter response in mixed radiation fields. Swaja, R.E.; Greene, R.T. (Oak Ridge National Lab., TN (USA)). *Radiation Protection Dosimetry;* **5**: No. 2, 101-108(1983).

Experiments were conducted to determine performance characteristics of neutron and gamma personnel dosimetry systems in mixed radiation fields produced using the Health Physics Research Reactor. The experiments consisted of measuring dose equivalents in known radiation fields, and determining personnel dosemeter responses to criticality accident conditions. Measured results are summarised and analysed for all three experiments.

34139 Low-background high-efficiency detector for the study of the (n,α) reaction at pulsed neutron source. Antonov, A.; Bogdzel, A.; Gledenov, Y.M.; Tishin, V.G. (Joint Institute for Nuclear Research, Laboratory of Neutron Physics H.P.O. Box 79, Moscow). *Nuclear Technology;* **59**: No. 3, 526-531(Dec 1982).

The reported alpha-particle detector consists of eight flat proportional chambers connected in pairs. It is designed for measurement of the (n,α) reaction on resonance neutrons from a pulsed neutron source with a pulse duration of about 50 ns. The target's total area is 10,000 cm^2, which allows the use of large amounts of investigated materials (up to 100 g). The detector is used as a low-background counter of alpha particles. Its background is $<3 \times 10^{-4}$ count/$cm^2 \times s$ at a neutron flux of $>10^6$ n/$cm^2 \times s$. For an integral neutron flux of about 10^{12} n/cm^2, stable operation of the detector was obtained.

34140 Source imaging using neutron pinhole cameras based on position-sensitive proportional counters. Johnson, R.G.; Behrens, J.W.; Bowman, C.D. (National Bureau of Standards, Washington, DC 20234). *Nuclear Technology;* **55**: No. 3, 724-727(Dec 1981).

A pinhole camera technique has been used to measure the variation in neutron emission intensity over the area of the neutron-producing target of the National Bureau of Standards Electron Linac. The method uses a one-dimensional position-sensitive proportional counter (PSPC) with an intrinsic spatial resolution of 1.0 mm. The pinhole is made in a thick sheet of cadmium and neutron energy (<0.3-eV) selection is achieved by time-of-flight. In a completely separate experiment, the neutron cone obtained from the (d,t) reaction using the associated-particle technique was imaged by a two-dimensional PSPC. This second measurement demonstrated the use of the two-dimensional detector for imaging high-energy (14-MeV) neutrons.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

34141 (AD-A—139930/2) Low power radiation hard GaAs RAM. Semi-annual technical report 10 Jun 82-9 Dec 83. Kirkpatrick, C.G.; Vahrenkamp, R.P. (Rockwell International Corp., Thousand Oaks, CA (USA). Microelectronics Research and Development Center). Mar 1984. 35p. NTIS, PC A03/MF A01.

The scope of this program is to demonstrate a 1K GaAs static RAM having very low power dissipation, 1 micro W/bit in standby, and a short access time, 10 ns, to meet the requirements of the DARPA Advanced On-Board Signal Processor (AOSP). In the six month period covered by this report the initial processing of the 1K RAM arrays was begun. Testing of several lots revealed a mask error which is currently being corrected. The isolation studies for ultra-low power devices continued with major emphasis on isolation degradation following the Schottky metal process. A theoretical formulation for the leakage behavior of GaAs substrates was initiated, and good agreement between theory and the experimental data was obtained. Upset measurements have been made on a number of 256 bit RAMs using an Am-241 alpha particle source. The numerical value for the failure cross section was found to be similar in magnitude to the area of the Schottky barrier speed-up

capacitor, suggesting that the capacitor is primarily responsible for the magnitude of the upset cross section. Single event upset measurements have also been carried out using 40 meV/protons at the NRL cyclotron facility. The results for this case also demonstrated a lower upset cross section for RAMs fabricated without the n(-) layer in the speed-up capacitor. A conceptual design of a new RAM mask set was begun in order to evaluate a wider range of RAM cell configurations. Both 256 and 1K bit arrays are being considered, and emphasis will be placed both on cell designs for enhanced yield and radiation hardness. Enhancement/depletion devices will also be incorporated into the design.

34142 **(HMI-B—380) GfW-handbook for irradiation test guidelines for radiation hardness of electronic components.** Braeunig, D.; Wulf, F.; Gaebler, W.; Boden, A. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik; Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.). Bereich fuer Projekttraegerschaften). Dec 1982. 239p. Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik.

The purpose of the report is to propose irradiation test methods so that a standardized application of the methods can lead to a better comparison of test results. The interaction of different radiation species with matter - ionization and displacement - is described. Application of appropriate radiation sources, dosimetry problems, and shielding for simulating space radiation effects by laboratory testing is discussed. The description and characteristics of the irradiation sources are presented. Flowcharts of the planning and running of irradiation tests are given. Guidelines for running the tests are established, test methods and test circuits are proposed. The test system offers the capability of measuring devices also of high complexity up to microprocessors. The test results are collected regularly and are published in GfW-Handbook TN53/08, 'Data Compilation of Irradiation Tested Electronic Components'.

34143 **(UCRL—15596) Response of multilayer films and mirrors to intense x-irradiation.** Watson, B.A.; Kohler, D.A.; Guttman, J.L. (Lockheed Palo Alto Research Labs., CA (USA). Applied Physics Lab.). 1984. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013221.

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Fluence levels at which component degradation occurs have been determined and the nature of the change in reflectivity resulting from x-ray induced damage has been characterized. For the case of the nickel mirror, damage occurred at x-ray fluence levels of 150 mJ/cm. Result of the damage was a decrease in reflectivity. For the case of the multilayer thin film structure, damage was observed at x-ray fluence levels of 500 mJ/cm, and the damage appeared as a broadening of the line width of the Bragg reflected x-rays and as a decrease in the reflection efficiency.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 32561, 32633, 32843, 33022, 33237, 33697, 33792, 34093

34144 **(CONF-8405183—2) Selective monitoring of hazardous chemicals in emergency situations.** Stetter, J.R.; Zaromb, S.; Penrose, W.R.; Otagawa, T.; Sincali, A.J.; Stull, J.O. (Argonne National Lab., IL (USA); Coast Guard, Washington, DC (USA)). 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013436.

From Joint Army Navy Nasa Air Force S and EPS annual meeting; Las Cruces, NM, USA (7 May 1984).

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A recently reported portable instrument for detecting, identifying, and monitoring chemical hazards, developed for alerting U.S. Coast Guard personnel to the presence of hazardous vapors, can monitor all or most of the approximately 30 compounds frequently encountered in JANNAF missions. The instrument uses an array of four different amperometric sensors operating in conjunction with two different noble-metal filaments that may be heated to either 900 or 1000°C. Operation of the sensor-filament array in four differently selective modes generates 16-parameter response patterns, each of which is characteristic of an individual compound. Histograms and response-versus-concentration plots presented for 17 compounds of interest to JANNAF members show that each compound is distinguishable from the others through its response pattern and that the sensor responses are proportional to the concentration of each compound in the usually encountered ranges (0-50 ppM or, for some compounds, 0-200 ppM). For the subject array, the estimated lower limit of detection ranges from about 0.1 ppM (for acetone, hydrogen sulfide, nitromethane, hydrazine, or chlorine) to 12 ppM (for nitrobenzene).

34145 **(DOE/ER/10845—T1) Surface-plasmon exploration of multilayer physisorbed and chemisorbed films on metal substrates.** Bretz, M. (Michigan Univ., Ann Arbor (USA)). 31 Mar 1984. Contract AC02-81ER10845. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014218.

Over the course of this 3 year DOE contract we have built up a high quality Surface Plasmon Resonance apparatus, surveyed Xe, O_2 and CO multilayer adsorption of silver, made several appropriate experimental modifications and then obtained data on low pressure bulk formation of Xenon multilayers. A publication of current Xe results is now in preparation.

34146 (INIS-BR—119, pp 164) **Thermocouple fixing device.** Nagy, G.P.; Pereira, V.Q. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

34147 (INIS-BR—119, pp 167) **Thermocouples fixing with small thickness steel plate.** Pereira, V.Q. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

34148 (INIS-BR—120, pp 92) **Digital fluorimeter.** Mello, H.A. de (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780396.

In Annual Progress Report of 1982.

34149 **(INIS-mf—8357) Method to process high signal rates in pulse analysis, illustrated by the example of X-ray spectroscopy.** Tadros, Y. (Bochum Univ. (Germany, F.R.). Abt. fuer Elektrotechnik). 27 Nov 1980. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780315.

In X-ray fluorescence spectroscopy, good resolution of amplitudes at high pulse rates is required. Three filters are presented by which, with appropriate compensation, the distortion due to the pile-up effect is avoided, the signal/noise rate is improved, and the processing rate is increased. A pile-up processor with RC1-filter is realised. (orig.).

34150 (INIS-mf—8365, pp 61-64) **Accelerator mass spectroscopy with completely stripped ^{36}Cl.** Ernst, H.; Korschinek, G.; Kubik, P.; Morinaga, H.; Nolte, E.; Ratzinger, U.; Teichmann, S.; Wild, E. 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number TI84780230.

In Annual report 1982 of the Beschleunigerlaboratorium of Univ. and Technische Univ. Muenchen.

The AMS method by means of completely stripped ^{36}Cl presented in the AR 1981 was further improved. The detection limit (1 ^{36}Cl event per hour measuring time) could be lowered by a factor about 100 to $^{36}Cl/Cl = 4 \times 10^{-15}$. (orig.).

34151 (INIS-mf—8901, pp 111-114) **Studies of particle emission from solid surfaces by means of direct-Reading Detectors.** Berger, S.; Besocke, K.; Hofer, W.O. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Grenzflaechenforschung und Vakuumphysik). 1983. NTIS (US Sales Only), PC A14/MF A01. Order Number TI84701920. (CONF-830120—Exc.).

From Symposium on surface science; Obertraun, Austria (30 Jan 1983).

An experimental set-up measuring differential sputtering yields and angular distribution of sputtered and/or evaporated particles is described. By beam switching the evaporation and sputtering components can be separated which is a problem at higher sample temperatures. As a specific application the temperature dependence of the differential sputtering yield of silver under atomic and molecular antimony bombardment is investigated. It is concluded that direct reading particle detectors can give valuable information in special areas. (G.Q.).

34152 (ORNL/TM—9112) **Invention of a tunable damper for use with an acoustic waveguide in hostile environments.** Rogers, S.C. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013109.

A damper was invented to remove undesirable stress pulses from an acoustic waveguide. Designed to be tunable, the damper was constructed to withstand a corrosive or otherwise hostile environment. It serves to simplify the design and enhance the performance of a water-level measurement system, of which the damper and acoustic waveguide are integral parts. An experimental damper was constructed and applied to an existing level probe and measurement system. The resulting damper, properly tuned, causes acoustic stress pulses that pass into it along the waveguide to be attenuated.

34153 (PB—84-160993) **On-site calibration of flow metering systems installed in buildings. Building science series.** Baker, D.W.; Hurley, C.W. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jan 1984. 157p. (NBS-BSS—159). NTIS, PC A08/MF A01.

Library of Congress catalog card No. 83-600626. Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, CA.

This report summarizes the various types of flowmetering devices used in energy management and control systems (EMCS), various methods for their initial calibration and, when practical, techniques for maintaining their calibration while they are in service. Emphasis is placed on the use of transfer reference meter systems, where the working meter is calibrated on site by connecting it in series with a calibrated transfer meter of any variety. Other methods of calibration are also described. Reference tables and the necessary equations for flow calculations are presented throughout the text and in the appendicies. Illustrative examples are given in detail for the calculation of flow using each type of metering device described.

34154 (SAND—84-0248C) **Rectangular heat source on a semi-infinite solid: an analysis of a thin film heat flux gage.** Keltner, N.R.; Beck, J.V.; Bainbridge, B.L. (Sandia National Labs., Albuquerque, NM (USA); Michigan State Univ., East Lansing (USA). Dept. of Mechanical Engineering). May 1984. Contract AC04-76DP00789. 22p. (CONF-840816—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012234.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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A thin film flux gage has been developed for a series of combustion experiments. The gage was designed to provide both rapid response and long use time. Initial calibrations using standard techniques indicated large differences between the literature and the estimated properties. In order to calibrate this gage without resorting the destructive property measurements, an analytical model of the gage response to a step heating current was developed. The model is in the form of three algebraic expressions which correspond to the early, middle, and late time regimes. The expressions are used to provide a framework for least squares estimates of the gage parameters. There is very good agreement between the model and the experimental data. The estimated parameter values demonstrate good to excellent repeatability and good agreement with both new literature data dnd results from destructive property measurements.

34155 (UCID—20093) **d/dt[B^2] detector: method of operation.** Cusson, R.Y.; Strayer, M.R.; Meldner, H.W. (Lawrence Livermore National Lab., CA (USA)). 30 May 1984. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013108.

The theory of operation for the ferrite-biased d/dt[$B^2(t)$] = B^2 - dot = d/dt{B^2], detector is outlined. The sensitivities of the calibration constant to the power level in the waveguide, the propagation mode, the temperature and the ferrite magnetization characteristics, are discussed. The differential version, coupled to a BALUN, is discussed.

34156 (UCRL—53522) **Development and capabilities of the LLNL Focused-Beam Reflection-Mode Acoustic Microscope.** Weglein, R.D. (Lawrence Livermore National Lab., CA (USA)). 25 May 1984. Contract W-7405-ENG-48. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013575.

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The development and preliminary evaluation of the Focused-Beam Reflection-Mode Acoustic Microscope [abbreviated Focused Reflection Acoustic Microscope (FRAM)] is described. This new facility represents a unique nondestructive evaluation (NDE) resource at LLNL. The report is organized along five major topics. The present and anticipated uses of the FRAM are first described. This is followed by a detailed, largely qualitative narrative of the instrumentation, with particular emphasis on the low-frequency lens design and extended diagnostic metrology capability. Key examples of imaging and metrological case histories are then described. A special case of complementary imaging and metrology - a preliminary diagnosis of spot-welds to silicon solar cells - is detailed more fully. Finally, two types of future efforts are proposed, instrument development that will widen the range of the FRAM uses and analytical development that will enhance quantitative NDE and lead to higher confidence in the decision-making capability.

34157 **Frequency spectrum analyzer with phase-lock.** Boland, T.J. (to Dept. of Energy). US Patent 4,430,611. 7 Feb 1984. Filed date 29 Jul 1981. vp.

PAT-APPL-288234.

A frequency-spectrum analyzer with phase-lock for analyzing the frequency and amplitude of an input signal is comprised of a voltage controlled oscillator (VCO) which is driven by a ramp generator, and a phase error detector circuit. The phase error detector circuit measures the difference in phase between the VCO and the input signal, and drives the VCO locking it in phase momentarily with the input signal. The input signal and the output of the VCO are fed into a correlator which transfers the input signal to a frequency domain, while providing an accurate absolute amplitude measurement of each frequency component of the input signal.

4404 Well Logging Instrumentation

34158 (UCRL—53509) **Development of a multidetector deflection measurement system. Final report, September 1982-August 1983.** Bissinger, H.D.; Robinson, W.L. (Lawrence Livermore National Lab., CA (USA)). 10 Apr 1984. Contract W-7405-ENG-48. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013580.

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This portion of the final report on the LABAN Laser Optical Line of Sight (LOLOS) project presents the technical portion of the development, including the final design, key calculations, an error budget analysis, environmental test results, and a summary noting critical technical issues.

45 EXPLOSIONS AND EXPLOSIVES

REFER ALSO TO CITATION(S) 34990

4501 Chemical

34159 (BMVg-FBWT—83-7) Determination of phlegmatizer concentration profiles in nitrocellose propellant grains by means of radioisotope tracer technique. Meier, H.; Boesche, D.; Zeitler, G.; Zimmerhackl, E.; Hecker, W. (Bundesministerium der Verteidigung, Bonn (Germany, F.R.); Staatliches Forschungsinstitut fuer Geochemie, Bamberg (Germany, F.R.)). Jul 1983. 102p. (In German). Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentationszentrum der Bundeswehr.

In continuation of studies with phthalate phlegmatizers labelled with carbon-14 the penetration behaviour of camphor and ethyl centralite into nitrocellulose propellant grains has been measured by applying the radiotracer technique. The tracer methods used for these measurements are based on the profile sectioning techniques in conjunction with liquid scintillation counting and autoradiography. Phlegmatizers have been labelled in this work with tritium. The measurements yield the values for diffusion coefficients, activation energies and frequency factors. In addition concentration profiles have been derived showing a continuous concentration decrease from the surface into the interior of the grain. Moreover, it could be shown that the trend of phlegmatizers to migrate in nitrocellulose propellant powders increases in the order ethyl centralite < di-n-butyl phthalate < camphor. Furthermore, a leveling of the concentration of phlegmatizers during storage at ambient temperature has been observed autoradiographically in camphor/propellant systems. By labelling different phlegmatizers with carbon-14 and tritium, respectively, the diffusion of a mixture of deterrents into propellants can be studied. Measurements with a mixture of C-14-di-n-butyl phthalate and T-ethyl centralite in ethanolic solution point, among others, to a leveling of both diffusion coefficients at higher values and an increase of the penetration depth contrary to the behaviour of the individual deterrents.

34160 (MLM—3157) Electrochemical properties of CP, HMX, RDX, and PETN. Wang, P.S.; Keil, R.G. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 18 Jun 1984. Contract AC04-76DP00053. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013675.

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The reduction of the ordnance compounds CP, HMX, PETN, and RDX proceeds irreversibly at a mercury electrode in neutral aqueous buffer solutions. CP undergoes electrochemical reduction with the greatest ease, followed closely by PETN, RDX, and HMX. The electrochemical study was complicated by the strong adsorption of HMX upon mercury. The reduction of RDX was found to be most complex, exhibiting some five well-defined cyclic voltammogram peaks. A thorough study of the electrode kinetics of any one of these compounds will necessitate the use of aprotic solvent systems. A detailed kinetic study of PETN in aqueous solutions is precluded by its limited solubility. In general, after the first wave, the reduction processes were found to be pH dependent.

34161 (SAND—84-0143C) CP DDT detonators. III. Powder column effects. Lieberman, M.L.; Begeal, D.R.; Durand, N.A.; Fleming, W. (Sandia National Labs., Albuquerque, NM (USA); Unidynamics/Phoenix, Inc., AZ (USA)). 1984. Contract AC04-76DP00789. 22p. (CONF-840867—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012238.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

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In this investigation, we have examined the effects of powder column parameters on transition to detonation behavior in CP detonators. Increasing powder loading pressure increases bulk powder density, decreases void volume, and leads toward inhibition of DDT. The extent of inhibition, however, is affected by initial particle size, not simply bulk powder density. This implies that inhibition does not simply correlate with void volume. It has been shown that individual CP crystals undergo considerable diminution during loading. Virtually all porosity remains open; however, as loading pressure increases, the largest pores are eliminated. Transition to detonation in such detonators appears to correlate with gas permeability of the column and the existence of pores greater than approx. 0.2 μm. The results imply that CP DDT is controlled by gas flow through a small percentage of the total pores present and a small percentage of the total pore volume.

34162 (SAND—84-0459C) Effect of oxide coated thickness on thermal ignition of titanium-based pyrotechnics. Erickson, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 20p. (CONF-840867—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013061.

From 9. international protechnics seminar; Colorado Springs, CO, USA (6 Aug 1984).

The effect which variations in oxide coating thickness can have on thermal ignition of titanium-based pyrotechnics was examined theoretically. The analyses were developed using previously published experimental studies of ignition mechanisms. Those studies indicated that ignition is controlled by the rate at which an already existing oxide coating dissolves in the bulk metal. The specific case of hot-wire ignition at near minimum energy was considered. It was assumed that oxide dissolution occurs by molecular diffusion, and an approximate ignition model was developed to examine the relative variations in ignition times which result from variations in oxide coating thickness. The model consists of a heat conduction equation for the wire and pyrotechnic and a Fick's-law diffusion equation, with Arrhenius-type diffusion coefficient, for the oxygen in the titanium particles. Calculations showed that the ratio of ignition times t/sub i_2//t/sub i_1/ could be estimated from t/sub i_2/t/sub i_1/ ≃ (h_2/h_1)/sup y/, where $y = 2/(1 + Q/6$ kcal $mole^{-1})$; h_2/h_1 is the respective ratio of oxide coating thicknesses, and Q is the oxygen-diffusion activation energy. Literature values for Q vary from 16 to 75 kcal/mole, while the exponent y varies from 0.6 to 0.2, respectively. At lower activation energies, moderate variations in oxide coating thickness could cause significant variations in ignition time.

34163 (UCRL—90318) Influence of diluents and inhibitors on detonations. Moen, I.O.; Ward, S.A.; Thibault, P.A.; Lee, J.H.; Knystautas, R.; Dean, T.; Westbrook, C.K. (Lawrence Livermore National Lab., CA (USA); Defence Research Establishment Suffield, Ralston, Alberta (Canada); Victoria Univ., British Columbia (Canada); McGill Univ., Montreal, Quebec (Canada)). 27 Jan 1984. Contract W-7405-ENG-48. 26p. (CONF-840801—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006300.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

The present paper reports on a series of experiments performed to determine the influence of chemical inhibitors and diluents on the detonability of fuel-air and fuel-oxygen mixtures. The influence of adding small amounts (1 to 3%) of CF_3Br, CF_4 and CO_2 to ethylene-air mixtures was determined by performing large scale critical tube diameter tests. The results of these tests show that the inhibition effect of CF_3Br on detonations is not nearly as dramatic as it is on flames. For detonations, the relatively chemically inert diluent CO_2 is found to be a better inhibitor than CF_3Br. Similar laboratory test with ethylene-oxygen and hydrogen-oxygen mixtures confirm the results obtained for fuel-air mixtures. In fact, the addition of small amounts of CF_3Br to these fuel-oxygen mixtures has a small sensitizing effect, whereas the influence of CO_2 is similar to that observed for fuel-air mixtures. The results are compared with the prediction of a detailed chemical kinetic model for the oxidation and inhibition processes. For CF_3Br, it is found that a chemical kinetic scheme derived from flame data predicts a detonation inhibiting effect much larger than that observed. Possible modifications of this scheme to obtain a consistent description of CF_3Br inhibition are proposed and discussed.

34164 **(UCRL—90322) Measurement of shock induced reaction in rocket propellants by nanosecond infrared radiometry and photography.** von Holle, W.; Kury, J.; James, E.; Scribner, K. (Lawrence Livermore National Lab., CA (USA)). 4 Jun 1984. Contract W-7405-ENG-48. 10p. (CONF-8406136—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013209.

From JANNAF propulsion systems hazards meeting; Aberdeen, MD, USA (18 Jun 1984).

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The technique of two-color infrared radiometry with 5 ns resolution was established as a useful tool in the investigation of shock-induced heating and reaction in high explosives, both in the detonation and build up phase, as well as inert pressed powders and propellants. These experiments all seem to form a consistent picture of hot spot formation and growth or cooling. The work on propellants has just begun; however, the results appear promising. Thus far the conclusions are consistent with the earlier findings concerning the high degree of involvement of the energetic binder. This may be modified by the increased evidence for initial concerted reactions of the binder and the solid interface to form hot spots, whose nature is sensitive to the solid components present.

4502 Nuclear

34165 **(AD-A—137174/9) Nuclear weapon accident exercise (NUWAX 83) after action report. Volume 2.** (Defense Nuclear Agency, Kirtland AFB, NM (USA)). 30 Dec 1983. 232p. NTIS, PC A11/MF A01.

See also Volume 1, AD-A136977.

Progress in improvement to the national capability to respond to a nuclear weapon accident has been extensive over the past four years. NUWAX-83 provided a number of important lessons. There appear to be several specific areas which offer the greatest opportunity to further enhance our response capability. These include: (A) Radiological guidelines--The absence of coordinated radiological procedures which would rapidly identify and quantify the radiological problem remains an area of weakness. Some examples are: The need to avoid undue public alarm during all phases of accident response, to assure contaminated civilians that they have been properly decontaminated, and to achieve agreement with state and local agencies that buildings, land. etc., have been cleaned up to a level of safety that has broad support among the scientific community. In the absence of some agreed criteria, the economic impact and legal aspects could be overwhelming. (B) Federal, state, and local planning; and (C) Expansion of training opportunities.

34166 **(AD-A—137386/9) Strategic target planning: bridging the gap between theory and practice.** Walker, R.L. (National Defense Univ., Washington, DC (USA). Research Directorate). 1983. 52p. NTIS, PC A04/MF A01.

In seeking a more flexible nuclear strategy, national policymakers may not be taking into account technical limitations to strategic target planning. This doubt is the driving concern behind this study. The author suggests that, because of recent changes in our nuclear strategy, the nuclear arsenal and the enemy target system, a gap may have developed between strategic targeting theory and practice. After tracing the evolution of nuclear targeting, he turns to ways of dealing with the technical constraints faced by target planners. His foremost concern is that strategic targeting concepts do not exceed our technical ability to implement. He proposes improvements in our strategic forces' command, control, and communications facilities to better ensure rapid retargeting . He also argues for more reliable and detailed target intelligence and recommends that a special coordination committee be created to oversee new targeting initiatives.

34167 **(AD-A—138988/1) Soviet theater nuclear capabilities: the European nuclear balance in transition.** Kennedy, R. (Army War Coll., Carlisle Barracks, PA (USA). Strategic Studies Inst.). 31 Aug 1983. 41p. NTIS, PC A03/MF A01.

This memorandum examined the changing strategic and theater nuclear environment; Soviet theater nuclear force improvements and doctrine; the implications of Soviet theater nuclear buildup for deterrence and the defense of Europe; and NATO's response. The author concludes that the changing balance of theater capabilities has resulted in a devaluation of deterrence, a decline in Western self-confidence, and an increase in NATO's vulnerabilities. The author also contends that if the Soviet Union is unwilling to negotiate a significant reduction intermediate-range nuclear forces that now pose a serious threat to the West, the NATO deployment of Pershing II and cruise missiles will not only help to restore balance to the NATO/Warsaw Pact nuclear equation, but will also enhance deterrence, reduce NATO's vulnerabilities, and thus, will contribute to crisis stability in Europe.

34168 **(AD-A—139015/2) Neutron leakage from 'COMET' - a duplicate Little-Boy device. Report for Sep-Oct 82.** Robitaille, H.A.; Hoffarth, B.E. (Defence Research Establishment, Ottawa, Ontario (Canada)). Dec 1983. 45p. (DREO—878). NTIS, PC A03/MF A01.

Abstract in French.

Fast neutron spectra between 600 keV and 10 MeV, directed outwards from the surface of the 'COMET' assembly, were measured using an NE-213 fast-neutron spectrometer at the Los Alamos National Laboratory. The COMET experiment, consisting of a duplicate Little-Boy device suitably modified for operation in the delayed-critical regime, was to provide improved energy and angular distributions of leakage spectra in support of efforts to re-evaluate ground doses from the Hiroshima bombing. Measurements were obtained at seven polar angles (from 0 to 135 degrees) and at two radii from the centre of the active volume (75 and 200 centimeters). These measurements were compared to two calculations available at the time of writing; one an earlier (1976) one-dimensional estimation and another more recent (1982) two-dimensional calculation, both based on Monte-Carlo techniques. Differences in high energy neutron leakage are apparent and probably due to dynamical considerations, as the theoretical calculations simulated the disassembling weapon itself, rather than the static experiments described herein.

34169 **(DOE/NV/10327—10) Operation Phalanx onsite radiological safety report, October 1982-September 1983.** Mullen, O.W.; Eubank, B.F. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). Jun 1984. Contract AC08-84NV10327. 102p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84013139.

Phalanx was the name assigned to the series of underground nuclear experiments conducted at the Nevada Test Site from October 1, 1982 through September 30, 1983. Remote radiation measurements were taken during and after each nuclear experiment by a telemetry system. Monitors with portable radiation detection instruments surveyed reentry routes into ground zeros before other planned entries were made. Continuous surveillance was provided while personnel were in radiation areas and appropriate precautions were taken to protect persons from unnecessary exposure to radiation and toxic gases. Protective clothing and equipment were issued as needed. Complete radiological safety and industrial hygiene coverage was provided during drilling and mineback operations. Telemetered and portable radiation detector measurements are listed. Detection instrumentation used is described and specific operational procedures are defined.

34170 **(OEVS-Mitteilung—1/83, pp 7-24) Possible kinds of nuclear weapons.** Tschirf, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780298. (CONF-8206244—).

From Annual meeting of the Austrian Association for Radiation Protection on protection of the population against radiation of nuclear weapons; Vienna, Austria (29 Jun 1982).

The physical principles of the A, the H and the neutron bomb and their radiation effects - including the electromagnetic pulse - are outlined. (G.Q.).

34171 (OEVS-Mitteilung—1/83, pp 25-38) **Prompt- and long-term radiation in atomic weapon explosions.** Kamelander, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Reaktorsicherheit). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780298. (CONF-8206244—).

From Annual meeting of the Austrian Association for Radiation Protection on protection of the population against radiation of nuclear weapons; Vienna, Austria (29 Jun 1982).

Generation and properties of prompt and long term radiation caused by atomic weapon explosions are explained. (A.N.).

34172 **(SAND—84-1199C) Lower confidence bounds on system reliability using component data: Maximus methodology.** Spencer, F.W.; Easterling, R.G. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 24p. (CONF-8406135—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012813.

From International conference on reliability and quality control; Columbia, MO, USA (4 Jun 1984).

A method of calculating approximate lower confidence bounds on system reliability, based upon binomial component data, is presented. The method is based on a system reduction algorithm by which the component data are reduced to effective binomial system data. The reduction rules treat series-parallel arrangements of components and also the use of the same data to estimate failure probabilities for different components. The confidence limits obtained are conservative for confidence levels of interest. We also discuss extensions to failure-rate estimation. This method was developed by an Ad Hoc Methodology Working Group on Nuclear Weapons Reliability Assessment, which was established by the Departments of Defense and Energy.

34173 **(SSS-R—84-6629) Calculations to assist in a new Hiroshima yield estimate. Final report, August 19-December 31, 1983.** Kennedy, L.W.; Roth, L.A.; Needham, C.E. (S-Cubed, Albuquerque, NM (USA)). 15 Jun 1984. Contract AC03-83ER60148. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013062.

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This report describes calculations and analysis performed in an attempt to provide a new estimate for the yield of the Hiroshima weapon. Newly discovered meteorological data was adapted for use in one- and two-dimensional hydrodynamic codes, and a series of calculations was then run for different values of yield. The objective was to determine what yield produced an overpressure record which could best be correlated with an actual trace measured at a parachute-dropped canister. Altitude of the bomb and canister-carrying aircraft at drop time was also a variable parameter. The analysis provides an estimate of 16.6 + 0.3 kt for the yield of the Hiroshima weapon. A drop altitude of near 35,500 feet is shown to be consistent with the signal time-of-arrival. This yield value is within the range of other estimates, but the drop altitude is higher than that previously assumed to be reasonable.

34174 **(UCRL—90095) Neutron and gamma dose and spectra measurements on the Little Boy replica.** Hoots, S.; Wadsworth, D. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1984. Contract W-7405-ENG-48. 37p. (CONF-840627—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013336.

From 29. annual meeting of the Health Physics Society; New Orleans, LA, USA (3 Jun 1984).

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The radiation-measurement team of the Weapons Engineering Division at Lawrence Livermore National Laboratory (LLNL) measured neutron and gamma dose and spectra on the Little Boy replica at Los Alamos National Laboratory (LANL) in April 1983. This assembly is a replica of the gun-type atomic bomb exploded over Hiroshima in 1945. These measurements support the National Academy of Sciences Program to reassess the radiation doses due to atomic bomb explosions in Japan. Specifically, the following types of information were important: neutron spectra as a function of geometry, gamma to neutron dose ratios out to 1.5 km, and neutron attenuation in the atmosphere. We measured neutron and gamma dose/fission from close-in to a kilometer out, and neutron and gamma spectra at 90 and 30° close-in. This paper describes these measurements and the results. 12 references, 13 figures, 5 tables.

34175 **Energy and water development appropriations for 1985. Part 6. Hearings before the Committee on Appropriations, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 1542p.

Part 6 of the hearing record covers testimony by representatives of DOE and the Nuclear Regulatory Commission (NRC) which was given in Executive Session over four days because of the sensitive nature of some of the information. The DOE witnesses discussed the design, testing, and manufacture of nuclear weapons and described DOE support for military applications of inertial fusion. Other responsibilities include the production, verification and monitoring of nuclear materials, and the dissemination of classified information. Chairman Nunzio Palladino and other officials of the NRC were asked to include comments on the licensing problems at the Byron and Zimmer plants in their review of the NRC budget requirements and program plans.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

34176 **(NUREG/CR—3759) Lightning strike density for the contiguous United States from thunderstorm duration records.** MacGorman, D.R.; Maier, M.W.; Rust, W.D. (National Oceanic and Atmospheric Administration, Norman, OK (USA). National Severe Storms Lab.). May 1984. 50p. NTIS, PC A03/MF A01 - GPO* $4.00. Order Number DE84901264.

An improved lightning ground strike climatology has been obtained from thunderstorm duration data recorded by 450 air weather stations. From lightning strike location data collected in Florida and Oklahoma, it was found that strike density could be estimated from thunderstorm duration by the equation N/sub s/ = $0.054H^{1.1}$, where N/sub s/ is the number of strikes per square kilometer and H is thunderstorm duration in hours. This relationship was applied to thunderstorm duration data from the aviation stations to obtain lightning strike density for the contiguous United States.

5001 Basic Studies

REFER ALSO TO CITATION(S) 32568, 34239, 34250, 34252

34177 **(AD-A—137863/7) Application of methods of numerical and software engineering analysis to physical and engineering data collected in a variety of laboratory and field measurement programs. Final report Sep 80-Sep 83.** Moss, P.; Wadzinski, H.; Dechichio, D.; Jenkins, A.; Meehan, P. (Bedford Research Associates, MA (USA)). 28 Oct 1983. 41p. NTIS, PC A03/MF A01.

This report presents a summary of analyses and mathematical modelling done in support of some AFGL atmospheric research projects. In particular, work on the problems of linear filtering on intensity data, broadening of peaks in the photoelectron energy spectrum, and interactive OPAQUE file editing are discussed.

34178 **(DOE/BP—257) Airborne wind measurements at Cape Blanco, Oregon.** Lin, J.T.; Veenhuizen, S.D. (United Industries Corp., Bellevue, WA (USA)). Dec 1983. Contract AC79-82BP34337. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013662.

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The airborne wind measuring system using a fixed wing airplane and a Loran-C navigation unit was proven to be feasible to provide the large scale background wind flow for initialization of numerical wind modeling. The rms errors in the airborne wind measuring system were +- 2 mph in wind speed and +- 12 degrees in wind direction. The advantages of this method were that wind speeds over a large area (5 miles x 14 miles, or 18 miles x 30 miles)

may be determined rapidly, economically and at altitudes above the normal altitudes of TALA kite mesurements. The disadvantages were that the spatial resolution of the measurements was poor and near surface measurements were not feasible using a fixed wing aircraft. 1 reference, 10 figures, 1 table.

34179 **(ORNL—6041) User's manual for TOX-SCREEN: a multimedia screening-level program for assessing the potential fate of chemicals released to the environment.** Hetrick, D.M.; McDowell-Boyer, L.M. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 295p. (EPA—560/5-83-024). NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84013619.

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A screening-level multimedia model called TOX-SCREEN has been developed to assess the potential fate of toxic chemicals released to air, surface water, or soil. Four types of surface water bodies are considered: lakes, rivers, estuaries, and oceans. TOX-SCREEN was developed at the request of the US Environmental Protection Agency (USEPA) to provide a means by which chemicals classified under Section 4 of the Toxic Substances Control Act (TSCA) can be rapidly evaluated with respect to their potential for accumulation in environmental media. The model is simplified in nature and is intended to be used as a screening device to identify chemicals that are unlikly to pose problems even under conservative assumptions. The purpose of this report is to provide a user's manual for the FORTRAN IV computer code, TOX-SCREEN, which implements the multimedia model. A brief description of the model assumptions and structure is included. The structure of the TOX-SCREEN program and individual subroutines are described in detail. Input to and output from the code are thoroughly explained. Parameter definitions, sample job control language, sample input data, output from TOX-SCREEN using the sample input data, and a listing of the program are provided in appendixes. Also, methods for estimating bioaccumulation in food chains, added recently to TOX-SCREEN, are documented in an appendix. 21 references, 9 tables.

34180 **(PB—84-155837) EPA (Environmental Protection Agency) Complex Terrain Model Development: third milestone report 1983. Interim report Jun 82-Jun 83.** Lavery, T.F.; Strimaitis, D.G.; Venkatram, A.; Greene, B.R.; DiCristofaro, D.C. (Environmental Research and Technology, Inc., Concord, MA (USA)). Nov 1983. 293p. NTIS, PC A13/MF A01.

See also PB84-220020.

The U.S. Environmental Protection Agency is sponsoring the Complex Terrain Model Development program, a multi-year integrated program to develop and validate practical plume dispersion models of known reliability and accuracy for simulating one-hour-average ground-level concentrations downwind of elevated sources during stable atmospheric conditions in complex terrain. The first major component of the Complex Terrain Model Development program was a field study conducted during the fall of 1980 at Cinder Cone Butte, a roughly axisymmetric, isolated 100-meter-tall hill located in the broad Snake River Basin near Boise, Idaho. The second field study was performed during 1982 at Hogback Ridge, an 85-meter-tall two-dimensional ridge located west of Farmington, New Mexico. This report documents work performed subsequent to the Second Milestone Report to combine two preliminary complex terrain models developed from the Cinder Cone Butte data base into the Complex Terrain Dispersion Model (CTDM), and to contrast the performance of CTDM with three existing complex terrain models using measurement data from both the Cinder Cone Butte and the Hogback Ridge field experiments. A description of the Hogback Ridge field study is also included.

34181 **(PB—84-157700) WNDCOM: Estimating surface winds in mountainous terrain. Forest service general technical report (final).** Ryan, B.C. (Forest Service, Berkeley, CA (USA). Pacific Southwest Forest and Range Experiment Station). 1983. 15p. NTIS, PC A02/MF A01.

WNDCOM is a mathematical model for estimating surface winds in mountainous terrain. By following the procedures described, the sheltering and diverting effect of terrain, the individual components of the windflow, and the surface wind in remote mountainous areas can be estimated. Components include the contribution from the synoptic scale pressure gradient, the sea breeze, the slope wind, and the valley wind. For each component, a brief description, the data and information needed for estimation, and step-by-step procedures are provided.

34182 **(PB—84-158302) User's manual for the Plume Visibility Model (PLUVUE II). Final report 23 Feb-29 Aug 83.** Seigneur, C.; Johnson, C.D.; Latimer, D.A.; Bergstrom, R.W.; Hogo, H. (Systems Applications, Inc., San Rafael, CA (USA)). Feb 1984. 293p. NTIS, PC A13/MF A01.

See also PB81-163297.

This publication contains information about the computer programs for the Plume Visibility Model PLUVUE II. A technical overview of PLUVUE II and the results of model evaluation studies are presented. The source code of PLUVUE II, as well as two sets of input and output data, is provided. This model is based on Gaussian dispersion assumptions, chemical reactions of plumes in nonurban atmospheres, light scattering and absorption characteristics of aerosols and gases, and radiative transfer along different lines of sight. PLUVUE II differs from the original Plume Visibility Model (PLUVUE) by an improved treatment of multiple scattering of light by aerosols and the incorporation of light absorption by carbonaceous aerosols. PLUVUE II is applicable to assessing visibility impairment due to pollutants emitted from well-defined point sources.

34183 **(UCRL—90053) Experimental and model transport and diffusion studies in complex terrain with emphasis on tracer studies.** Dickerson, M.H.; Foster, K.T.; Gudiksen, P.H. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 18p. (CONF-8403119—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013076.

From OHOLO conference on boundary layer structure; Zichron Ya'acov, Israel (25 Mar 1984).

The U.S. Department of Energy (DOE) Atmospheric Studies in Complex Terrain (ASCOT) program began in the fall of 1978 as a multiple DOE and other Federal Laboratory program devoted to developing a better physical understanding of atmospheric boundary layer flows in areas of complex terrain. The first technical challenge undertaken by the program was an investigation of atmospheric boundary layer phenomena associated with the development, continuation and breakup of nocturnal drainage wind flows. This paper discusses the general objectives the program has addressed during the past several years and focuses on results from a major field experiment conducted in 1980 in The Geysers area of northern California. Specifically, results from measurements of simultaneous tracer releases are compared to calculations from a mass-consistent wind field model coupled to a particle-in-cell transport and diffusion model. Results of these comparisons show that model calculations agree with measurements within a factor of 5 approximately 50 percent of the time. Part of the difficulty faced by the models in these comparison studies is associated with large variabilities between measurements made by samplers located one or two Δx apart when compared to the resolution of the models. Space and time averaging improves the comparisons considerably, although the design of the field experiment did not allow the determination of optimum spacial and temporal averages. 14 references, 9 figures, 2 tables.

34184 **Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging.** Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). 714p. (CONF-821136—Vol.1). Elsevier Science Publishing Co., Inc., 52 Vanderbilt Avenue, New York, NY 10017. Order Number TI84002447.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

These two volumes contain papers prepared for and presented at the Fourth International Conference on Precipitation Scavenging, Dry Deposition, and Resuspension (the Chamberlain Meeting) held during 29 November to 3 December, 1982 in Santa Monica, California. Papers presented are abstracted separately.

34185 Pollutant deposition as a result of interception of wind-driven cloud - measurements made at a site in northern England. Dollard, G.J.; Unsworth, M.H. (Univ. of Nottingham School of Agriculture, England). pp 161-170 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Cloud droplet fluxes to vegetation at a moorland site in northern England were measured. Deposition rates for various elements contained in the droplets were determined. Concentrations of sulfate and nitrate in cloud water were much higher than expected for rainfall in the area indicating that scavenging in clouds is responsible for much of the chemical content of precipitation.

34186 Significance of snow crystal and mountain-surface riming to the removal of atmospheric trace constituents from cold clouds. Borys, R.D.; Demott, P.J.; Hindman, E.E.; Feng, D. (Colorado State Univ., Fort Collins). pp 181-190 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

On the average, at SPL, cloud water contains 3 times the acidity and 4 to 5 times the conductivity of unrimed snow crystals. Rime deposits directly to the mountain surface and on ice crystals can contribute more than 60% of the total water in the snowpack. Combining these results with the observed factor of 10 enrichment of trace constituents in rime ice, up to 94% of the total trace constituents in a snow pack may be due to rime ice deposits, excluding below-cloud and dry depositional processes. This data set is small and preliminary. General agreement with other observations suggest it may be applicable in other regions. Further studies are needed to broaden the data base and to include soluble ion and trace element chemistry of the snow and cloud water. Efforts should be made in the future to address the cause of the observed variability in snowfall chemistry by linking in-cloud scavenging processes with sources of natural and man-made aerosol particles and gases. 19 references, 1 figure, 1 table.

34187 In-cloud scavenging and resuspension of cloud active aerosols during winter storms over Lake Michigan. Saxena, V.K.; Hendler, A.H. (North Carolina State Univ., Raleigh). pp 91-102 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). Contract AS05-81EV10498.TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Analysis of extensive measurements of cloud condensation nuclei (CCN) activity are presented to describe the fate of the aerosol population as it interacts with the clouds. Simultaneous measurements of atmospheric sulfate content and measurements of cloud water composition recorded by the Battelle, Pacific Northwest Laboratory (PNL) are analyzed here to determine the effectiveness of the cloud nucleation process in accounting for the sulfate content of cloud water. The sampling program was conducted during November 1978 and January 1979, in cooperation with the PNL and under the auspices of the Multi-State Atmospheric Power Production Pollution Study (MAP3S). Some results from the MAP3S program have previously been presented. 27 references, 3 figures, 4 tables.

34188 Characteristics of non-precipitating stratiform clouds. Castillo, R.A.; Jiusto, J.E. (State Univ. of New York, Albany). pp 115-124 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The study of precipitating versus non-precipitating stratiform clouds at Whiteface Mountain, New York indicates that there is some modification of the cloud droplet spectra as evidenced by a significant difference between median LWC d_o, (student's test: 10% level of confidence). The three different methods of obtaining liquid water content were all in good agreement and (d_o) gave the best indication of droplet spread. The cloud water chemistry of dissipating stratus and non-precipitating stratus indicated pH values of 3.5 and 3.7, with a pH of 5.0 for precipitating stratiform. In the three categories presented, the $[H^+]$, $[NH_4^+]$, $[Na^+]$, $[Mg^{+2}]$ and $[Ca^{+2}]$ all indicated significant differences at the 5% level of confidence. An intercomparison of $[NH_4^+]$, $[SO_4^{-2}]$ and $[NO_3^-]$, indicates the importance of the $[NO_3^-]$ in contributing to cloud water acidity. In both categories - precipitating and non-precipitating - the evidence points toward strong acid formation within the cloud. 10 references, 5 tables.

34189 Design and calibration of a rotating arm collector for ambient fog sampling. Jacob, D.J.; Flagan, R.C.; Waldman, J.M.; Hoffmann, M.R. (California Inst. of Tech., Pasadena). pp 125-136 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The design of the collectors to sample ambient fog for chemical analysis has been discussed. A rotating arm collector where droplets impact at high speed in slots milled into the leading edges of a rotating rod was found to satisfy criteria for fog sampling. The experimentally determined size cut is 8 μm, which excludes the submicron aerosol from the sample while collecting most fog droplets with high efficiency. The sampling rate is 5 $m^3\ min^{-1}$, and collection rates up to 2 ml min^{-1} have been obtained in the field. A lower size cut could be achieved by using a longer arm and thus increasing the impacting speed of the droplets. This implies the use of airfoil shapes or smaller collection bottles to cut down drag. Such prototypes are being built at Caltech but have not yet been tested in a wet environment. 14 references, 3 figures, 1 table.

34190 Fogwater composition in southern California. Waldman, J.M.; Munger, J.W.; Jacob, D.J.; Hoffmann, M.R. (California Inst. of Tech., Pasadena). pp 137-148 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Exceedingly high concentrations of SO_4^{2-}, NO_3^-, NH_4^+ and H^+ were observed in fogwater collected in southern California, highest during fog events following smoggy days. The pH of most samples ranged from 4.0 to 2.5. Secondary aerosols represent the most likely source of these solutes. High levels of trace metals, sulfite and formaldehyde were also observed. Physical processes (i.e., condensation and evaporation) along with scavenging of gaseous and aerosol components appear to control observed fogwater composition. Chemical processes occurring within fog droplets seem also to contribute to the high level of acidity found. Scavenging of ammonia (gaseous or particulate) and calcareous dust was observed to partially neutralize acidity due to NO_3^- and SO_4^{2-} and their precursors. 34 references, 2 figures, 2 tables.

34191 Chemistry of nighttime urban fogs. Jacob, D.J.; Hoffmann, M.R. (California Inst. of Tech., Pasadena). pp 149-160 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A model has been developed to interpret the observed chemistry of urban fogs. Droplet-phase S(IV) oxidation is found to be a significant source of sulfate, and H_2O_2 and O_3 (metal-catalyzed) are the important oxidants. At ambient formaldehyde concentrations the formation of the formaldehyde-sulfite adduct has no effect on the net S(VI) formation rate. Predicted fogwater concentrations are found to be consistent with field results. The present model needs to be refined further by the use of multidimensional calculation routines to allow for a complete treatment of complexation and precipitation equilibria. Scavenging of small aerosol particles by diffusion may also be significant and will be included in future generations. 12 references, 2 figures, 4 tables.

34192 Characterization of the inorganic chemistry of the precipitation of North America. Semonin, R.G.; Bowersox, V.C. (Illinois State Water Survey, Champaign). pp 191-202 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). Contract AC02-76EV01199.TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The inorganic chemistry of precipitation of North America has not been adequately described in the past due to the inadequacy of available data. The recently initiated national networks for precipitation sampling in both Canada and the United States have now been in operation sufficiently long to permit a first estimate of the relative and absolute concentrations of various ionic constituents. Among the principal features of the several distributions are (1) the sea salt constituents, sodium and chloride, exhibited relative maximums along the east and west coastal regions of North America; (2) elements commonly associated with crustal dust, that is, magnesium and calcium, maximized in the continental interior; (3) relative ammonium maximums are seen in the central Great Plains and may be associated with particular agricultural practices in that area; and (4) those ions of most concern to air quality and acidic precipitation considerations maximize in the industrialized east with the sulfate and nitrate maximums in southern Ontario paralleling the St. Lawrence valley and the hydrogen ion maximum in the US over the Ohio River valley.

34193 Interpretation of sequential rain sampling results. Asman, W.A.H.; Jonker, P.; Slanina, J.; Baard, J.H. (Inst. for Meteorology and Oceanography, Utrecht, Netherlands; Netherlands Energy Research Foundation, Petten). pp 265-274 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Two sequential rain samplers were used to collect simultaneous samples in order to examine the statistical variability of sequential sampling on an event basis. Concentrations of two components were compared by plotting, on a logarithmic scale, each component versus the sample number. Because there was always some statistical variability in a data, a procedure to compare concentration curves was developed which would take statistical variability into account. For SO_4 and NO_3, the error function seems to be very good as for more than 80% of the couples of samples the internal difference is less than 10%. For the other parameters sampled, the curves were less satisfactory and may be due to the relative low concentration of the components in the rain events sampled. 3 references, 8 figures, 2 tables.

34194 Vertical variability and short-term temporal trends in precipitation chemistry. Munger, J.W.; Waldman, J.M.; Jacob, D.J.; Hoffmann, M.R. (California Inst. of Tech., Pasadena). pp 275-282 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The series of precipitation collectors in Pasadena and the adjacent mountain slopes are ideal for testing scavenging models. Relatively clean air masses in Pacific storms interact with the polluted air in the Los Angeles basin. Contact time between the two airmasses is short. Pollutants in Los Angeles are either mixed rapidly into the overlying clouds, where the aerosol may act as condensation nuclei, or they are removed by below-cloud scavenging, which is most effective for gases and large particles. Data collected so far suggest that BCS, primarily of gases, accounts for up to half of the H^+, NH_4^+, and NO_3^- present in Los Angeles area precipitation. Dissolution of SO_2 and oxidation to H_2SO_4 within the falling raindrops also appears to be important. The concentrations observed in high altitude precipitation suggest that some mixing of pollutants into the clouds must occur. The present data are insufficient to judge the relative importance of in-cloud and below-cloud scavenging for stratus-cloud precipitation. 9 references, 2 figures, 4 tables.

34195 Nitrate in precipitation: how are the observed concentrations explained. Altwicker, E.R. (Rensselaer Polytechnic Inst., Troy, NY). pp 283-292 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Order-of-magnitude analysis starting with observed field concentrations of gaseous nitric acid and nitrate ion in precipitation makes the aqueous phase concentrations plausible. In-cloud processes would appear to lead to equilibrium concentration, below cloud processes may encounter higher (than in-cloud equilibrium) gas phase concentrations, but there may not be sufficient time to reach equilibrium. Though there appears to be a weak inverse relationship between gas phase nitric acid concentration and concentrations found in precipitation, the diurnal variation in nitric acid in the gas phase is as large or larger, which means that the above analysis needs to be extended to understand other removal processes. 21 references, 4 figures, 1 table.

34196 Precipitation scavenging of submicron particles released by rockets into convective clouds. Lacaux, J.P.; Warburton, J.A. (Centre de Recherches Atmospheriques, Observatoire du Puy de Dome, France; Desert Research Inst., Reno, NV). pp 303-314 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Two case studies are presented. The objective of each study was to determine the trajectory, residence time and dispersion of AgI particles introduced into clouds by the soviet-type rockets as a function of the internal structure of the cloudy cells. Three-dimensional and temporal radar measurements of the internal structure of 2 storm cells show: they were unicellular with well-defined cores of precipitation; and the trajectories of the rockets were confined to the precipitation columns which were the locations of the maximum reflectivities. The silver content of the precipitations gives the same response for the 2 storms as follows: the residence time of

AgI particles in clouds was very short; the particles were confined and scavenged in the columns of precipitation; and the 2 cases exhibited spotty deposition. These results were then compared to results reported from the USSR. 6 references, 5 figures, 4 tables.

34197 **Rate and chemistry of wet deposition derived from time series of natural radioactivity.** Weiss, W.; Wagner, C.; Schlosser, P.; Stockburger, H.; Sartorius, H.; Volpp, J.; Ditschmann, R.; Wagenbach, D.; Muennich, K.O. (Universitaet Heidelberg, Germany; Rosastrasse, Freiburg, Germany). pp 315-322 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Time series of natural radioactivity as used in this paper provide a powerful tool for the study of the wet removal processes. They are particularly useful if the mechanisms and the efficiency of the removal processes are to be investigated during individual precipitation events. A comparison of the atmospheric inventory with the radioactivity flux to the ground provides additional information about the tracer balance and the processes in question. The behavior of the tracer used is different from that of many other constituents of the atmosphere inasfar as it is continuously produced within the atmosphere by radioactive decay of the noble gas ^{222}Rn. A continuation of this work therefore has to include other atmospheric constituents which do not show this particular behavior. From the methods available for a measurement of other constituents the electrical conductivity measurement has been chosen because it provides the same time resolution as the radioactivity measurement. Instrumentation for continuous conductivity measurements during precipitation has been developed, and preliminary results are available.

34198 **Coupled gas-phase/aqueous phase free radical chemistry of a cloud.** Chameides, W.L.; Davis, D.D. (Georgia Inst. of Tech., Atlanta). pp 431-444 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Model calculations which simulate the time dependent, coupled gas-phase and aqueous-phase chemistry of a cloud indicate that free radicals can have a major impact upon the generation of acids in cloudwater. For an accommodation coefficient of 0.01, roughly one-half of the SO_2 converted to SO_4^{2-} was found to be caused by aqueous-phase free radical reactions. Principal among these is the reaction of aqueous-phase OH with HSO_3^-. Reactions of dissolved SIV with H_2O_2 and O_3 were also found to be important in producing SO_4^{2-}. Furthermore the reaction of aqueous-phase OH with $OHCH_2OH$, the dissolved form of H_2CO, was found to lead to a significant rate of production of HCOOH in cloudwater. It should be noted that large uncertainties are associated with the calculations. Many of the aqueous-phase rate constants used in the model are not well-defined. The uncertainty in the OH and HO_2 accommodation coefficients is a potential source of significant error. Furthermore, the model neglected and simplified many of the complex dynamical and microphysical processes of clouds (i.e. a monodisperse, temporally constant droplet distribution was assumed, temperature was held fixed, and entrainment was neglected). 34 references, 4 figures.

34199 **Theoretical and experimental study of SO_2 scavenging by cloud and rain drops.** Walcek, C.; Mitra, S.; Topalian, J.; Pruppacher, H.R. (Univ. of California, Los Angeles). pp 445-452 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

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A mathematical model was developed to simulate the diffusion of sulfur dioxide into a raindrop falling at terminal velocity. The model was simplified by considering total sulfur rather than each sulfur component and by assuming a spherical vortex and velocity scales comparable to observed velocities. The model was verified by a series of laboratory experiments. Results supported the model up to drop sizes greater than 600 μm. Sulfur absorption at this size was significantly greater than predicted. This was due to enhanced eddy diffusion in larger particles. The model was changed to incorporate this behavior. 10 references, 4 figures.

34200 **Laboratory measurements of aerosol activity spectra enhanced by the aqueous phase oxidation of SO_2.** Lamb, D.; Gertler, A.; Robinson, N.; Katz, U.; Miller, D. (Univ. of Nevada System, Reno). pp 471-482 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Cloud chamber experiments of SO_2 oxidation to sulfate within cloud droplets have confirmed that the particles resulting from the subsequent evaporation of these droplets are larger and exhibit lower S/sub c/ values than the original CCN. Calculations invoking Koehler theory, atmospherically relevant cloud situations and aqueous SO_2 conversion rates point to conditions where this CCN activity enhancement is significant, i.e., in a subsequent cloud involvement these CCN assume a preferential role as early acting nuclei. With the use of a cloud mixing model it was shown that entrainment of dry air into a cloud may provide conditions that give the enhanced CCN an even better advantage for growing into larger droplets than would be the case at initial condensation at cloud base. Thus, the CCN enlargement by in-cloud SO_2 scavenging and oxidation may be the first stage in a process of selective precipitation scavenging of sulfates. 18 references, 6 figures, 1 table.

34201 **Solubility measurements of aerosols in the Greenfield gap to determine efficiency of in-cloud scavenging by nucleation.** Alofs, D.J.; Trueblood, M.B. (Univ. of Missouri, Rolla). pp 483-492 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A study was conducted to determine whether a size region exists where nucleation causes scavenging of all cloud particulates. In order for this to occur, the following propositions must be true. Proposition A is, there exists a critical radius (a^*) such that all particles with $a > a^*$ are scavenged by nucleation, and all particles with $a < a^*$ are not scavenged. Proposition A would be true if the following two propositions are each true: proposition B, all particles of the same size have the same critical supersaturation (S/sub c/), and S/sub c/ is a decreasing function of particle size; and proposition C, each cloud has a supersaturation (S^*), such that all particles with S/sub c/ $< S^*$ nucleate cloud droplets and particles with S/sub c/ $> S^*$ do not. Proposition C is assumed to be true for marine aerosols, proposition B (and, hence, proposition A) is false, but for continental aerosols it is probably true, especially in highly industrialized regions such as greater eastern United States. 23 references, 2 figures, 1 table.

34202 **Deposition of submicron particulates on model scavengers.** Podzimek, J.; Martin, J.J. (Univ. of Missouri, Rolla). pp 493-504 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Information about the type of motion of 28 planar models falling in quiescent air was obtained and several important parameters such as the mean values of V/sub z/, V/sub x/, C/sub D/, N/sub Re/, and N/sub Be/ amplitude and frequency of the oscillatory motion were determined. Comparison of the results of the analysis of stroboscopic pictures of models falling in still air with the behavior of similar models falling through a horizontal air flow of 0.7 m/s shows that one can find mean values of aerodynamic parameters of falling scavengers, except the situation when the model starts to tumble. The experiments with disk type models exposed to smoke particles in a wind tunnel demonstrated that in the range of N/sub Re/ from 100 to 700, a considerable part of particles is deposited on the rear side of scavengers. The total scavenging efficiency of these models is between 1% and 2%, depending on the N/sub Re/ and type of aerosol. The swinging of the models will probably not change much the total scavenging efficiency of disk type models. 15 references, 8 figures.

34203 **Scavenging of submicron particles in mixed clouds: physical mechanisms - laboratory experiments.** Prodi, F. (Istituto Fisbat-CNR, Bologna, Italy). pp 505-516 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

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A review of the scavenging mechanisms and of their superposition indicates that transient phenomena and their relaxation times should be better investigated. Time dependent treatments are required in particular by the time dependent Brownian motion, by the oscillations of falling crystals, and by thermal effects induced by the actual shapes of the crystals. The main results of the experimental tests are: a remarkable decrease in aerosol concentration is observed when cloud droplets evaporate toward growing ice crystals (this supports the efficacy of thermophoretic collection by evaporating droplets suggested by Slinn and Hales); and the examination of individual crystals has shown that growing ice crystals are scavengers of NaCl aerosol particles in the small size range. On the other side no scavenged particulates of 0.35 μm size of carnauba wax have been detected on ice crystals. The main limit in the experimental procedure followed is in the short growth times and consequent small crystal sizes which can be reached. To overcome these limitations a new experimental arrangement has been designed in which ice crystals are grown suspended in a gentle updraft in a closed circuit tunnel located in the cold room. 9 references, 4 figures.

34204 **Particle scavenging by evaporating cloud drops.** Beard, K.V.; Ochs, H.T. III; Leong, K.H. (Illinois State Water Survey, Champaign; Univ. of Illinois, Urbana). pp 517-528 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The capture efficiency for a hollow particle has been determined as a function of collector drop size. The particle was sufficiently large so that phoretic theory in the slip regime should apply. On the other hand the particle mass was quite small and inertial capture was insignificant. The measured capture efficiencies for this unusual particle were significantly above values predicted by theory. The consistency of the experimental data and our analysis of potential experimental errors suggest that the measured values are reliable. Therefore, the discrepancy between observation and theory may result from an insufficiency in phoretic theory or an inadequacy in the application of this theory to our experiment. If this is the case our computations would indicate an underestimation of the effects of thermophoresis by theory. The phoretic capture efficiencies obtained for the cenospheres at about 91% relative humidity are comparable to the capture efficiencies of particles due to charge effects in thunderstorm conditions. Hence, for cenospheres or particles with low conductivity, thermodiffusiophoresis may be a major mechanism promoting particle capture by hydrometeors. However, the limited data presented here and in other works does not provide a definitive assessment of phoretic particle capture. In addition the atmospheric aerosol is composed of a substantial fraction of wet or liquid particles, especially in high humidity conditions, and the phoretic scavenging of such particles needs to be evaluated. 16 references, 2 figures.

34205 **Comparison of in-cloud scavenging by Brownian diffusion and thermo and diffusio-phoresis.** Carstens, J.C.; Martin, J.J. (Univ. of Missouri, Rolla). pp 529-540 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

This study provides a basic model coupling phoretic and diffusive transport. The model is then used to evaluate the extent to which phoresis alters purely diffusive scavenging. Special attention is given to its retarding tendency in-cloud. Under conditions of growth, phoresis opposes diffusion. That is, phoretic drift tends to retard diffusive scavenging. 12 references, 1 table.

34206 **Experimental study of electrostatic effect on aerosol scavenging by snow crystals.** Murakami, M.; Magono, C. (Hokkaido Univ., Sapporo, Japan). pp 541-550 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

In order to study the electrostatic charge effect on the collection efficiency, experiments on snow scavenging were carried out using natural snow crystals in an aerosol chamber. The following results were obtained. The enhancement of collection efficiency due to the snow crystal charge increased with the decreasing aerosol size, and became the maximum at around 0.2 μm in diameter. And as for the submicron aerosol particulates the enhancement was about one order of magnitude. 3 references, 5 figures, 1 table.

34207 **Laboratory study of the scavenging of sub-micron aerosol by charged raindrops.** Barlow, A.K.; Latham, J. (UMIST, Manchester, England). pp 551-560 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The collection efficiencies (E) for small charged raindrops falling through a cloud of submicron aerosols were measured. The results agree with other workers, however, the scatter in the data is large. The tendency for E to increase with charge was confirmed and the values of E for charges similar to those of thunderstorms were near 1%, which is about two orders of magnitude greater than the corresponding values in the absence of electrical forces.

No systematic differences were found between positive and negative drops. 15 references, 5 figures.

34208 **Effect of electric charges on the efficiency with which columnar ice crystal scavenge aerosol particles.** Wang, P.K.; Chuang, C.H. (Univ. of Wisconsin, Madison). pp 561-572 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The collection efficiencies of charged aerosol particles scavenged by ice crystals are presented. Calculations are based on columnar ice crystals and use the flux method of Wang and Pruppacher. Approaches for other shapes are also presented. 13 references, 5 figures.

34209 **Theoretical study of the effect of atmospheric turbulent motions on the scavenging of aerosol particles by cloud and rain drops.** Grover, S.; Pruppacher, H.R. (Univ. of California, Los Angeles). pp 583-588 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A two model theoretical approach for the study of the effect of turbulence on the inertial impaction-type scavenging of large aerosol particles is presented. Each model computes individual particle trajectories relative to the collector drop. Such trajectories, which are the result of numerical integration of the particle equation of motion, are governed by the air flowing around the falling collector drop, the inertia of the particle, the gravitational force on the particle, and the ambient turbulence. The first model evaluates the effect of vertical accelerations of the drop relative to the air caused by the turbulence. The second model treats the effect of the smallest scale of turbulence, namely the Kolmogorov microscale, on the motion of the aerosol particle. 8 references.

34210 **Turbulent aspects of rainout.** Rosenkilde, C.E.; Serduke, F.J.D. (Lawrence Livermore National Lab., CA). pp 589-596 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The possible effect of atmospheric turbulence on enhancing the in-cloud scavenging of aerosol particles with radii $0.01 < r < 1$ μm which may interact with cloud water droplets having radii $5 < r < 30$ μm was studied. No significant augmentation due to turbulence of the Brownian diffusivity within the context of convective diffusion of submicron aerosols to cloud droplets in normal fields of atmospheric turbulence was identified. This leaves only the augmentation of the settling velocity which is much less than a factor of 15 except in extreme circumstances. The overall enhancement of the scavenging kernel in the presence of turbulence, over that for common convective diffusion, seems difficult to increase beyond a factor of 4 even in the most favorable circumstances. 12 references, 2 tables.

34211 **Numerical simulation of aerosol capture and deposition by a precipitating convective cloud.** Murray, F.W. (Univ. of California, Los Angeles). pp 609-616 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A model has been developed to provide aerosol deposition rates under a variety of atmospheric conditions. A series of simulations with varying initial soundings and aerosol distributions, aerosol sizes, and microphysical parameters are planned. The results will show the rate at which aerosol is brought to earth and the geometrical patterns of deposition. It will also show the redistribution of aerosol in the atmosphere as a result of thermal convection. Further simple computations will show the efficiency of various kinds of thermal convection in capturing and bringing aerosol materials to the earth. 17 references.

34212 **Distribution of acidity in convective clouds due to the aqueous phase oxidation of sulfur dioxide by ozone: a numerical simulation.** Sarma, R.A. (South Dakota School of Mines and Technology, Rapid City). pp 617-626 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A two-dimensional cloud model has been used to simulate the aqueous phase oxidation of sulfur dioxide by ozone in convective clouds. It was found that the acidity of cloud water is a function of its location in the cloud. Simulation of sulfur dioxide effluents from a 1000MW power plant suggests that the rain from a cloud close to the source could be 2.5 times more acidic than the rain from a cloud 4 km away from the source. 23 references, 4 figures.

34213 **Three-dimensional mesoscale numerical simulation of atmospheric cleansing during the 1982 Boulder upslope cloud observation experiment (BUCOE).** Chaumerliac, N.; Nickerson, E.; Rosset, R. (Laboratoire Associe de Meteorologie Physique, Clermont-Ferrand, France; National Oceanic and Atmospheric Administration, Boulder, CO). pp 627-648 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A three-dimensional, time-dependent mesoscale model with the capability of predicting precipitation over mountainous terrain has been extended to include aerosol precipitation scavenging processes. The model links the dynamical, microphysical, and scavenging processes, thereby accounting for advection, attachment to cloud droplets, and the removal by rain and ice of the aerosol particles. The main results are summarized below. The upslope situation is well reflected by the model; clouds are building up over the Rocky Mountains and spreading out on the plains. The precipitation pattern provides rain in the vicinity of Denver, the only precipitation area observed. The model produces a very small amount of ice, which is in agreement with observations on the 11th of May, but which made it difficult to quantitatively evaluate the ice scavenging parameterization in this particular simulation. The ice scavenging parameterization was, however, tested in another case. We notice the same behavior in the number aerosol concentration, both in the presence of clouds and without clouds, as was observed during the experiment. Vertical profiles of aerosol concentration reveal that in the presence of precipitation, scavenging is very evident and that otherwise advection effects dominate. The main feature of our results is that the model has the capability to simulate aerosol removal by precipitation as a two-stage process: rain scavenges not only aerosols free in the air but also aerosols already attached to cloud droplets. 12 references, 9 figures, 1 table.

34214 Intercomparison of the washout of $SO_4$2p from a single-layer regional transport model with a multilayer vertical-motion regional transport model. Davis, W.E. (Pacific Northwest Lab., Richland, WA). pp 663-674 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

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The main conclusion is that there are obvious differences between the results of the eight-layer model and the constant-layer model. The inclusion of vertical motion significantly changed the air concentrations as well as deposition of SO_4^{2-}. A preliminary conclusion is that the eight-layer model run in a series of modes was not able to compute air concentration patterns and deposition results that fit the observed. The best fit of the air concentrations was with using only the diurnal rate of conversion of SO_2 to SO_4^{2-}. The best fit of the deposition was found using the eight-layer model with in-cloud conversion. The constant layer model did a poor job in fitting the observed air concentrations as well as the observed wet deposition. There are two recommendations. The first, is to use models with vertical motion simulation for acid rain, and the second is that a better description should be provided of chemical transformation under conditions of saturation of SO_2 to SO_4^{2-}. 22 references, 5 figures, 2 tables.

34215 Effects of in-cloud scavenging on the transport and gas phase reactions of SO/sub x/, NO/sub x/, HC/sub x/, H/sub x/O/sub y/, and O_3 compounds. Carmichael, G.R.; Kitada, T.; Peters, L.K. (Univ. of Iowa, Iowa City; Toyohashi Univ. of Tech., Japan; Univ. of Kentucky, Lexington). pp 675-686 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A preliminary investigation into the effects of in-cloud scavenging on the vertical distribution of trace gases using a one-dimensional subset of a recently developed regional-scale combined transport/chemistry model has been presented. The model has sufficient detail to model urban boundary layer as well as non-urban free troposphere chemistry, boundary layer-free troposphere exchange in cloud free and cloudy environments, and in-cloud wet removal and chemistry processes. Results from test calculations show that clouds can greatly effect the vertical distributions by affecting the photon flux both below and directly above clouds, and by the preferential removal of the soluble gases in the cloud. 4 references, 3 figures, 3 tables.

34216 Precipitation scavenging of highly soluble gases. Dawson, G.A.; Brimblecombe, P. (Univ. of Arizona, Tucson; Univ. of East Anglia, Norwich, England). pp 687-696 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

With some simplifying assumptions as to physical processes and cloud types, a mean coefficient for wet removal of highly soluble gases has been calculated; it was close to 3×10^{-6} s^{-1}, i.e., a residence time of about 4 days. The calculations indicated that mean scale heights of such gases are likely to be less than 2 km. For this paper, the criterion of high solubility was taken to be K/sup H/ $\geqq 10^5$ mol l^{-1} atm^{-1}. Gases that are effectively highly soluble include HCl, HNO_3, H_2SO_4, H_2O_2, NH_3 in acid droplets, and SO_2 in the presence of strong oxidants. The treatment should have most applicability to highly soluble gases originating at or near the surface. 14 references, 3 figures.

34217 Statistics of wet deposition. Baker, M.B.; Egbert, G.; Erickson, K.B.; Harrison, H. (Univ. of Washington, Seattle). pp 697-706 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

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Results obtained from a stochastic model of the atmospheric portion of a tracer life cycle, which does explicitly incorporate the event nature of the precipitation sink are summarized. This extends earlier work which focused on the computation of the statistics of the airborne concentration of a tracer for which the major sink was wet deposition. In Section II the earlier model is reviewed, and in Section III it is extended to the calculation of distributions of the tracer concentration in precipitation. In Section IV the computation of extreme event frequencies, and in Section V the effect of transport, which requires the transformation of precipitation statistics from the Eulerian frame in which they are measured to the Lagrangian frame of the tracer are described. Section VI briefly reviews the results of comparison of model predictions with data and describes needed future work. 8 references.

34218 Spatial inhomogeneity of aerosols within an air parcel and some implications for the modelling of particle scavenging by convective clouds. Lozowski, E. (Univ. of Alberta, Edmonton). pp 707-718 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

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The use of a stochastic equation to model the statistics of convective scavenging is discussed. Implicit in this notion is the view that pollution properties are random variables, describable in terms of a probability density function with certain statistical properties. Equations are then compared to atmospheric chemistry data collected over Ontario in September 1981. 9 references, 3 figures.

34219 Precipitation scavenging and tropospheric mixing. Rodhe, H. (Univ. of Stockholm, Sweden). pp 719-729 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

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A simple transport/scavenging model has been used to demonstrate that treating vertical mixing through the troposphere and scavenging by clouds and precipitation as separate processes can lead to significant errors in the estimate of vertical distribution of certain water-soluble trace gases. The direct association of the scavenging with the vertical mixing process requires the following modifications to be made of the classical equation for diffusion and scavenging. The numerical value of the vertical diffusivity is reduced by a factor that depends upon the average efficiency of removal per mixing step. If the removal efficiency is asymmetric relative to the upward and downward moving eddies, a virtual vertical velocity has to be introduced. For normal cloud scavenging, this velocity can have a magnitude of a few mm s^{-1} for highly soluble gases. This effect is distinct from the vertical velocities introduced in a diffusion model by allowing for vertical variation of the air density or the eddy diffusivity. It is also distinct from the downward velocity imposed on aerosol particles and water-soluble gases by the sedimentation of the cloud droplets. The rate of removal is dependent upon the diffusivity, the average mixing length and the removal efficiency. The latter part of the paper contains a qualitative discussion of the application of the above concepts - the removal efficiency, in particular - to certain important trace compounds. It is shown that the cloud filter is particularly efficient for

NH_3 diffusing upwards from the surface. In areas with alkaline droplets, SO_2 should be trapped with a similar high efficiency. 11 references, 1 table.

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REFER ALSO TO CITATION(S) 32564, 32567, 32569, 32570, 32571, 32572, 32573, 32574, 32575, 32576, 32577, 32578, 32579, 32580, 32581, 32583, 32584, 32585, 32623, 32624, 32625, 32626, 32627, 32628, 32629, 32630, 32631, 32632, 32664, 33043, 34194, 34303, 34318, 34320, 34321, 34322, 34327, 34336, 34339, 34340, 34341, 34342, 34343, 34344, 34345, 34476, 34478, 34479, 34484, 34493, 34494

34220 **(AD-A—137879/3) Chemical reactions and molecular aggregation in cryogenic whole air sample matrices. Final technical report 1 Oct 81-31 Mar 83.** Calo, J.M.; Lilly, W.D. (Brown Univ., Providence, RI (USA). Dept. of Engineering). Jul 1983. 119p. NTIS, PC A06/MF A01.

This report conveys the results of an investigation concerned with the effects of chemical reactions in cryogenically condensed NOx/Ox/H_2O samples, on the alteration of sample composition upon subsequent thermal desorption. These studies were undertaken to elucidate the relevant mechanisms and improve the understanding of these processes as they relate to the analysis of cryogenically-collected stratospheric whole air samples acquired in the balloon-borne sampling project of the composition task of the Stratospheric Environment Program of the Air Force Geophysics Laboratory. The results of this work indicate that interconversion of the oxides of nitrogen in condensed samples, especially in the presence of water vapor, is a significant process under certain conditions. However, additional work involving careful cryogenic deposition of very small amounts of the various species, combined with perhaps high resolution FTIR, is definitely needed in order to quantitatively assess the relative importance of these same processes in the much more highly dilute stratospheric cryogenic whole air samples.

34221 **(AD-A—139475/8) Influence of mixture distribution on emissions from an aircraft piston engine. Final report Jun 74-May 78.** Mirsky, W.; Nicholls, J.A. (Michigan Univ., Ann Arbor (USA). Dept. of Aerospace Engineering). Oct 1980. 83p. NTIS, PC A05/MF A01.

Cylinder-to-cylinder mixture ratio distributions were measured for both the injected and carbureted versions of the AVCO-Lycoming 0-320 engine to determine the effects of non-uniform distribution on the exhaust emissions of carbon monoxide, hydrocarbons, and oxides of nitrogen. Data for both normal and lean-out conditions were obtained. An experimental Turbulent Flow Manifold for the carbureted engine was tested as a potential means for improved cylinder-to-cylinder distribution. Results showed improvements for the low power operating modes but deterioration for the high power modes. An analysis based on test results predicts that the EPA emission requirements can be met, for this engine, by improving mixture distribution and leaning both the taxi-out and approach modes. Improvements in fuel economy are also predicted.

34222 **(BNL—34842) PRECP: PRocessing of Emissions by Clouds and Precipitation. The Department of Energy's program on the nonlinearity of acid precipitation processes. Summary of FY 1984-1985 Operational Plan.** Michael, P. (ed.). (Argonne National Lab., IL (USA); Brookhaven National Lab., Upton, NY (USA); Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC02-76CH00016. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013119.

This report presents a summary of the FY 1984-1985 Operational Plan for the US Department of Energy's Program on the PRocessing of Emissions by Clouds and Precipitation (PRECP). Activities scheduled through 1985 are spelled out in some detail; the FY 1986 activities are sketched in somewhat less detail; and the plans for beyond FY 1986 are outlined in rather general terms. The full Operational Plan will be the third report in this series; the first report was the Preliminary Program Plan, which bore the title Nonlinearity of Acid Precipitation Processes (Michael, 1983). The objective and strategy of this project can be stated as follows: to determine how the wet deposition of acidic and other pollutants depends upon inputs to individual storms, by understanding the chemical and physical PRocessing of Emissions by Clouds and Precipitation (PRECP), through analysis of appropriate data, model development and testing, and laboratory and field studies, and for applications in the definition of the relationships between pollutant releases and subsequent deposition. 2 references, 4 figures, 5 tables.

34223 **(CONF-840501—1) CO_2 forecasting and control: a mathematical approach.** Daly, T.A.; Goto, N.; Kosobud, R.F.; Nordhaus, W.D. (Argonne National Lab., IL (USA); Yale Univ., New Haven, CT (USA); Illinois Univ., Chicago (USA)). 1984. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013454.

From Meeting of the American Association for the Advancement of Science; New York, NY, USA (24 May 1984).

Future concentrations of CO_2 were estimated by means of a mathematical programming approach. Certain price-sensitive demands for energy and a number of alternative technologies for meeting those energy demand paths are specified. Least cost is assumed for meeting energy demands. 4 references, 7 figures, 5 tables. (ACR)

34224 **(DTH-LET-RE—83-6) Total emission of CO, Hydrocarbons and NOsub(x) from the Danish carpark. Prognosis from year 1980 until 2000.** Schramm,J. (Danmarks Tekniske Hojskole, Lyngby. Lab. for Energiteknik). 1983. 105p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750995.

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The total emission of carbon oxides, hydrocarbons and nitrogen oxides from the Danish automobiles is forecasted for the period 1980-2000. Gasoline cars and diesel trucks are simulated. Models are based on data for the respective vehicles. Some samples from the existing carpark have been tested for purpose of emission factors establishment.

34225 **(EML—423) Environmental Measurements Laboratory annual report 1983.** Volchok, H.L.; de Planque, G. (USDOE Environmental Measurements Lab., New York). Mar 1984. 123p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84013758.

Short descriptions of the more than 100 projects engaged in during the year are presented. Research for the most part involved the study of acidified lakes, the use of lake and reservoir sediments for understanding regional pollution history and further research on evaluating U.S. population doses from fallout resulting from atmoshperic nuclear tests in Nevada in the 1950's.

34226 **(EPRI-CS—3182-Vol.1) Proceedings of the 1982 joint symposium on stationary combustion NO/sub x/ control. Volume 1. Utility boiler applications.** (Electric Power Research Inst., Palo Alto, CA (USA)). Jul 1983. 703p. (CONF-8211146—Vol.1). Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101.

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

More than 50 papers describing recent advances in NO/sub x/ control technology were presented. These papers covered the following topics: utility boiler field experience; NO/sub x/ regulations; advanced combustion processes; NO/sub x/ flue gas treatment; limestone injection SO/sub x/ control; industrial process combustion; industrial, commercial, and residential systems; and fundamental combustion research. The Symposium Proceedings has been published in two volumes: Volume 1 - Utility Boiler Applications and Volume 2 - Fundamental Studies and Industrial/Commercial/Residential Applications. Separate abstracts were prepared for each paper.

34227 (EPRI-CS—3182-Vol.1, pp 3.1) **Update on acid deposition.** Demerjian, K.L. (Environmental Protection Agency, Research Triangle Park, NC). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Acid deposition is a complex phenomenon which involves the interaction of a variety of atmospheric processes. These include meteorological processes which contribute to transport, dry deposition, and wet scavenging as well as chemical transformation processes which predominantly produce the acidic substances from precursor emissions such as NO/sub x/ and SO_2 and also effect the processes of dry deposition and wet scavenging. A review of these atmospheric processes and discussion on the outstanding issues which remain to be resolved are presented. In addition, a review of present generation acid deposition simulation models is presented with a discussion of their shortcomings and the direction future generations of models are likely to take. Finally, a brief overview of the Atmospheric Processes Program underway as part of the Federal Interagency Task - National Acid Precipitation Assessment Plan is also presented.

34228 **(LA—10086-MS) LIDAR measurements in the vicinity of the Kingston Steam Plant, Tennessee, during March 18-22, 1981.** Horak, H.G.; Whitaker, R.W.; Karl, R.R.; Argo, H.V. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013876.

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During March 18 through March 22, 1981, personnel of the Los Alamos Earth and Space Sciences Division performed LIDAR measurements in the vicinity of the Kingston Steam Power Plant in Tennessee in order to determine the spatial distribution of aerosols in the ambient atmosphere and the optical thicknesses of the plumes emerging from the two 305-m-tall plant stacks. Simultaneously, particulate concentrations were being measured at the ground during the course of the Harvard Air Pollution/Lung Study Program; this program concerned the exposure to air particulates experienced by selected individuals and groups who lived in the towns of Kingston and Harriman. It was suggested that the Harvard data may correlate with the aerosols emitted by the stacks. The LIDAR observations were made during a period of westerly air-flow aloft with generally high visibility (30 to 40 km). The data were recorded on magnetic tapes and analyzed at Los Alamos. The LIDAR determined ambient extinction coefficients near the ground rarely exceeded 0.15 km^{-1} except on March 22 when overcast and rainy skies prevailed. Slant path data for the ambient air occasionally showed an increasing aerosol concentration with height, and/or a changing aerosol phase-function with height. Interesting plume-like or layered features, sometimes of short duration, were occasionally detected at low elevations. The structures of some cloud layers were measured, and the heights of their bases and tops determined. The optical thicknesses ofthe stack plumes were generally less than 0.09 with mean extinction coefficients $\sim$ 0.2 to 0.4 km^{-1}; the plumes did not approach the ground. Therefore, little correlation could be found between the stack effluent and the Harvard Lung Program measured aerosol concentrations at the ground. 1 reference, 36 figures, 5 tables.

34229 **(LA—10095-MS) Copper smelters and atmospheric visibility in national parks and wilderness areas in the southwest.** Nochumson, D.H.; Williams, M.D. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013856.

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This report presents the results of a study that has compared two strategies for controlling sulfur oxides emitted from 11 southwestern copper smelters in terms of their effect on atmospheric visibility at 14 southwestern national parks and wilderness areas. The two alternative control strategies are supplementary control systems and continuous emission controls. The SO/sub x/ emissions for the CEC alternative are one-third those for SCS. The results from seasonal and episodic analyses are presented in this report. Statistical analyses were also performed on aerosol and visibility measurement data from before and during the summer 1980 copper smelter strike. The regional transport models used for predicting ambient sulfate concentrations were calibrated using historical data. According to model predictions, the CEC alternative would significantly improve visibility at five or six of the eight areas for two seasons of the year. The smelters were found to be a significant contributor to visibility reduction in seven out of eight of the areas studied. The strike period's SO_4 concentrations were substantially reduced from levels during the nonstrike period at almost all of the aerosol monitoring sites studied whereas visibilities had a much less than expected improvement. 39 references, 29 figures, 46 tables.

34230 **(LBL—16659) Control of respirable particles and radon progeny with portable air cleaners.** Offermann, F.J.; Sextro, R.G.; Fisk, W.J.; Nazaroff, W.W.; Nero, A.V.; Revzan, K.L.; Yater, J. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013878.

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Eleven portable air cleaning devices have been evaluated for control of indoor concentrations of respirable particles and radon progeny. Following injection of cigarette smoke and radon in a room-size chamber, decay rates for particles and radon progeny concentrations were measured with and without air cleaner operation. Particle concentrations were obtained for total number concentration and for number concentration by particle size. In tests with no air cleaner the natural decay rate for cigarette smoke was observed to be 0.2 hr^{-1}. Air cleaning rates for particles were found to be negligible for several small panel-filters, a residential ion-generator, and a pair of mixing fans. The electrostatic precipitators and extended surface filters tested had significant particle removal rates, and a HEPA-type filter was the most efficient air cleaner. The evaluation of radon progeny control produced similar results; the air cleaners which were effective in removing particles were also effective in removing radon progeny. At low particle concentrations plateout of the unattached radon progeny is an important removal mechanism. Based on data from these tests, the plateout rate for unattached progeny was found to be 15 hr^{-1}. The unattached fraction and the overall removal rate due to deposition of attached and unattached nuclides have been estimated for each radon decay product as a function of particle concentration. While air cleaning can be effective in reducing total radon progeny, concentrations of unattached radon progeny can increase with increasing air cleaning. 39 references, 26 figures, 9 tables.

34231 **(LBL—17274) Measurement of sulfur dioxide in the post-combustion environment.** Lucas, D.; Morrow, M.D.; Brown, N.J. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 24p. (CONF-840801—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006755.

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

Tunable Atomic Line Molecular Spectroscopy (TALMS) has been used to measure sulfur dioxide in the post flame region of an atmospheric pressure stoichiometric methane/air flame. The technique is sensitive and highly selective and thus is useful for research and commercial applications. Response is linear to 20,000 ppM in a 7 cm path length, with a limit of detection of $\sim$ 2000 ppM at 1500 K and $\sim$ 40 ppM at 300 K. Ultraviolet absorption spectra of SO_2 were recorded in the 205 to 220 nm range at various temperatures, and reveal significant broadening due to rotational redistribution at the higher temperatures, and no interference from other combustion products. TALMS signal dependence on magnetic field strength confirms that the same transition is observed in the flame as at room temperature. Fluorescent quenching of SO_2 by combustion products were measured in a Thermo Electron model 40 analyzer. Plots of S_0/S-1 are linear and yield relative quenching coefficients which increase in the order: Ar, CO_2, O_2, H_2, CH_4, CO, and C_6H_6. Significant quenching corrections are needed to accurately determine SO_2 concentrations in combustion mixtures, especially for the case of rich combustion, where large concentrations of CO, unburned hydrocarbons, and aromatic soot precursors may be present. 28 references, 6 figures, 1 table.

34232 (MST-LUFT-A—73) Studies of aerosols in the Greenland atmosphere. SAGA I: results 1979-1980. A base report. Heidam, N.Z. (Miljoestyrelsen, Roskilde (Denmark). Luftforureningslab.). Oct 1983. 169p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751004.

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The SAGA-project - Studies of aerosol in the Greenland Atmosphere - was started in August 1979 in order to obtain a comprehensive description of the level and composition of the Arctic aerosol and their seasonal variations. In this report results from the first year of operation are described. Filter samples of the aerosol have been collected at 5 stations, Viz. at Thule in northwest and Nord in northeast Greenland, at Godhavn on the west coast and Kap Tobin on the east coast and at Prins Christianssund at the southern tip of Greenland. The latter station has only been in operation for limited periods. The measuring stations are running continously and collect two samples each week. The filters are subjected to PIXE-analysis which yields concentrations of the elements detected in the aerosol. Usually 15-25 elements are detected. In order to elucidate the causes for the variations and intercorrelations of the many aerosol constitutens simplifying models of the aerosol have been constructed. The models show that the atmospheric aerosol in Greenland can be considered to be composed of 4-5 different components. The naturally occurring crustal component and the anthropogenically derived combustion component, which has a pronounced winter maximum, seem to be of very distant origin. The crustal component in summer appears to be of indigeneous origin while the combustion component is absent. However, the naturally occurring marine component is linked to mesoscale transport mechanisms inasmuch as it appears to be controlled by the oceanic ice cover in the Greenland waters. The metallic component is controlled by atmospheric transport porcesses on a large scale. However the nature of this transport is not known.

34233 (NUREG/CR—3773) Variation of planetary boundary layer dispersion properties with height in unstable conditions. Hicks, B.B. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Air Resources Labs.). May 1984. 51p. NTIS, PC A04/MF A01 - GPO $4.00. Order Number DE84901286.

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Recent developments in surface boundary layer and planetary boundary layer meteorology are combined to evaluate the height dependence of the dispersion parameters σ/sub z/ and σ/sub y/ of the familiar Gaussian plume relationships. Recommendations are based on analyses of surface boundary layer data, such as are collected at industrial sites under existing NRC guidelines. 25 references, 9 figures.

34234 (ORNL/CDIC—1/R1) Inventory of numeric data for carbon dioxide research. Revision 1. Watts, J.A. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 270p. NTIS, PC A12/MF A01; GPO Dep. Order Number DE84013683.

This report is an update of the 1983 inventory documenting the results of a survey to determine the status and availability of numeric data for application in carbon dioxide research and modeling studies. The inventory focuses on the identification, status, and accessibility of data pertenent to the carbon dioxide research programs of the US Department of Energy Carbon Dioxide Research Division. The inventory process will continue to evolve as research programs proceed and new data are collected or identified as being needed for specific research efforts. This report is one mechanism of promoting contributor/user interaction. It is hoped that the report will give direction to secondary users of the data by identifying the primary collectors, the types of data collected and availability, and how the data have been applied and/or interpreted. It serves as a guide for the Carbon Dioxide Information Center (CDIC) in the acquisition, organization, documentation, and evaluation of data to meet research needs. Descriptions of newly identified datasets and corrections to existing data descriptions will be issued periodically.

34235 (PB—84-121375) National emissions report, 1981: national emissions data system of the aerometric and emissions reporting system. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jan 1984. 1647p. (EPA—450/4-83-022). NTIS MF A01.

See also PB82-106527.

This report summarizes annual cumulative estimates of source emissions of five criteria pollutants: particulates, sulfur oxides, nitrogen oxides, volatile organic compounds, and carbon monoxide. Source emissions data are reported to the U.S. Environmental Protection Agency under provisions of Section 110 of the Clean Air Act, as amended in 1977, and of EPA Regulations, Title 40. Code of Federal Regulations, Part 51.321. Summary data are presented for the nation as a whole, for individual states, for intrastate and individual interstate portions of Air Quality Control Regions, and for total interstate Air Quality Control Regions.

34236 (PB—84-145101) Evaluation of the disposal of flue gas cleaning wastes in coal mines and at sea: refined assessment. Final report Jun 75-Sep 83. Lunt, R.R.; Cooper, C.B.; Reyman, A.S.; Johnson, S.L.; Bodek, I. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jan 1984. 224p. NTIS, PC A10/MF A01.

See also PB-269270.

The report gives a refined assessment of the feasibility of disposing of flue gas cleaning (FGC) wastes in coal mines and at sea. Its focus is on specific impact areas identified in an earlier assessment. These areas were further investigated through laboratory studies as well as an additional review of published information. For FGC waste disposal in coal mines, the issues addressed are: (1) physical stability of FGC waste deposited in surface mines; (2) effects of freezing on waste dewatering/drainage; (3) fugitive emissions from handling and disposal; (4) leaching of total oxidizable sulfur (TOS) from sulfite-rich wastes; (5) release of gases from waste deposits; and (6) corrosion potential for concrete bulkheads used for containment in underground mines. For disposal of FGC wastes at sea, the impact issues studied were: (1) the physical fate in the water column during descent from conventional barge disposal; (2) benthic transport and sedimentation of dumped FGC waste; and (3) depletion of oxygen due to dissolution of TOS from sulfite-rich wastes. These issues represent potential environmental impacts which may require evaluation for specific disposal conditions. In general, existing controls can mitigate such impacts; e.g., modification of waste properties and waste placement methods.

34237 (PB—84-151984) Comprehensive assessment of the specific compounds present in combustion processes. Volume 3. National survey of organic emissions from coal fired utility boiler plants. Final report, task 52. Haile, C.L.; Stanley, J.S.; Walker, T.; Cobb, G.R.; Boomer, B.A. (Midwest Research Inst., Kansas City, MO (USA)). Sep 1983. 236p. NTIS, PC A11/MF A01.

See also PB84-140870.

This study was conducted as a part of a nationwide survey to determine organic emissions from major stationary combustion sources. The principal compounds of interest are polynuclear aromatic hydrocarbons (PAHs) and chlorinated aromatic compounds, including polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). This report describes the methods and results of sampling and analysis activities at the seven plants constituting the nationwide survey of coal fired utility boiler plants.

34238 (PB—84-155373) Performance test results and comparative data for designated equilvalent methods for sulfur dioxide. Michie, R.M. Jr.; Sexton, F.W.; McElroy, F.F.; Thompson, V.L. (Research Triangle Inst., Research Triangle Park, NC (USA)). Jan 1984. 140p. NTIS, PC A07/MF A01.

The U.S. Environmental Protection Agency designates specific ambient monitoring methods and analyzers as reference or equivalent methods acceptable for use in certain required monitoring. Such designation is based on test of the performance of the analyzer model by the manufacturer (or other applicant) prior to designation. After designation, EPA carries out further tests of the an-

alyzer, including performance tests as well as comparative tests to evaluate the performance, reliability, and operational peculiarities of the analyzer with respect to other analyzers monitoring the same pollutant. This report summarizes both the manufacturer's predesignation test results and the available EPA postdesignation test results for currently designated sulfur dioxide analyzers. Manufacturer's predesignation test results are presented for thirteen analyzers, and all test results met or exceeded the specifications. EPA postdesignation performance test results are presented for ten analyzers, and similarly, all test results met or exceeded the specifications. EPA postdesignation comparative test results are presented for eight analyzers, with the results indicating that the analyzers tested were generally stable and reliable and demonstrated a high degree of comparability.

34239 **(PB—84-161439) EPA (Environmental Protection Agency) Complex Terrain Model Development description of a computer data base from small hill impaction study No. 1, Cinder Cone Butte, Idaho. Final report.** Truppi, L.E.; Holzworth, G.C. (Energy and Environmental Research Corp., Irvine, CA (USA)). Feb 1984. 117p. NTIS, PC A06/MF A01.

See also PB83-220020.

As part of the U.S. Environmental Protection Agency's effort to develop and demonstrate a reliable model of atmospheric dispersion for pollutant emissions in irregular mountainous terrain, the Complex Terrain Model Development Program was initiated. The first phase, a comprehensive tracer field study, was carried out on Cinder Cone Butte, Idaho, during the autumn of 1980. Eighteen quantitative tracer experiments were conducted, each lasting 8 hr at night or early morning. The main tracer gas was sulfur hexafluoride; a second tracer, Freon 13B1 was used in ten of the eighteen experiments. Averaged meteorological data were recorded from six towers near and on the slopes of the hill. Data consisted of direct and derived measures of temperature, wind, turbulence, solar and net radiation, and nephelometer coefficient of scattering. Hourly wind profiles were obtained from pilot balloon observations; tethersonde observations recorded profiles of wind and temperature. Tracer gas concentrations were detected by a network of approximately 100 samplers located on the slopes of the hill. The system used to collect the data, the operation procedures used to run the system, and its performance record are described. Tables of tracer gas release data have been included to assist in any modeling effort. All meteorological and tracer concentration data have been edited and recorded on magnetic tape and are now available, upon request, at the National Computer Center, R.T.P., NC, either as copies or by interactive computer access.

34240 **(PB—84-162601) Determination of cloud parameters for Neros II from digital satellite data. Final report 30 Sep 81-30 Mar 83.** Behunek, J.L.; Vonder Haar, T.H.; Laybe, P. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Mar 1984. 50p. NTIS, PC A03/MF A01.

As part of the input for their regional-scale photochemical oxidant model of air pollution, known as the Regional Oxidant Model, requires statistical descriptions of total cloud amount, cumulus cloud amount, and cumulus cloud top height for certain regions and dates. These statistics are used to parameterize photochemical reactions, and to diagnose vertical transport of pollutants. The purpose of this work was to derive these statistics from digital satellite data. The first stage of the work was to apply a human-computer interactive technique to satellite data to distinguish cumulus clouds from clouds of other types, and to produce the cloud amount statistics for cells within specified grids. Next, the interactive technique was applied to the infrared data to calculate the mean cloud top temperature for each cell. Those mean temperatures were then converted to heights by referring to objectively analyzed temperature versus height information derived from radiosonde data. A frequency distribution of cumulus cloud top heights was also produced for some cases.

34241 **(PB—84-173095) Acid deposition: atmospheric processes in eastern North America, a review of current scientific understanding.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1983. 381p. NTIS, PC A17/MF A01.

Sponsored in part by Carnegie Corp. of New York, Charles E. Culpepper Foundation, Inc., New York, Andrew W. Mellon Foundation, New York and Alfred P. Sloan Foundation, New York. Library of Congress catalog card No. 83-61851.

There is no observational evidence of a strong nonlinearity in the relationship between annual average total emissions and total deposition of sulfur in eastern North America. The finding is supported by theoretical calculations using the best available laboratory measurements of photochemical rate parameters. Currently available models of long-range atmospheric transport and transformation are not sufficiently developed to assess relationships between emissions from specific sources and deposition at specific receptor sites with high reliability.

34242 **(PB—84-179886) Fundamental study of sulfate aerosol formation, condensation, and growth. Final report Oct 80-Sep 82.** Yung, S.C.; Rangaraj, C.N.; Hancock, B.L.; Ugale, D.; Calvert, S. (Air Pollution Technology, Inc., San Diego, CA (USA)). Mar 1984. 187p. NTIS, PC A09/MF A01.

The report gives results of a study of the formation and growth of sulfate particles. Existing theoretical models on acid particle formation and growth were reviewed and evaluated. The formation and growth of sulfate particles during slow cooling, rapid cooling, and dilution cooling of flue gas were experimentally determined and compared with theories. The experimental results show that the temperature at which the self-nucleation of sulfuric acid occurs is lower than the acid dew point temperature. Thus, if the flue gas is slowly cooled to between dew point and nucleation temperatures, it is possible to force the sulfuric acid to condense out on surfaces, rather than form fine particles. The theories, experimental methods, and results are described.

34243 **(PB—84-184233) Buffer additives for lime/limestone slurry scrubbing synthesis, mass transfer, and degradation. Final report Oct 80-Oct 83.** Rochelle, G.T.; Smith, R.J.; Weems, W.T.; Hsiang, M.W.; Lee, T. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). Apr 1984. 287p. NTIS, PC A13/MF A01.

The report gives results of experimental studies, performed with buffer additives, useful for flue gas desulfurization by lime/limestone slurry scrubbing. The most attractive acids for further testing are adipic, mixtures of waste dibasic organic, sulfosuccinic, hydroxypropionic, and hydroxyacetic acids.

34244 **(PNL-SA—12117) Modeling wet-removal processes in the atmosphere.** Laulainen, N.S.; Easter, R.C.; Hales, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 11p. (CONF-840374—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013261.

From APCA specialty meeting on environmental impact of natural emissions; Research Triangle Park, NC, USA (7 Mar 1984).

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This paper gives a status report and overview of the PLUVIUS series of interpretive scavenging models. Intended primarily for the evaluation of precipitation-scavenging mechanism from field-study data, this model series is somewhat unique in that its member codes simulate the phase-transformation processes associated with precipitation formation. This allows both gaseous- and aqueous-phase chemical mechanisms to be simulated in a direct manner, thus avoiding some of the nonspecific parameterizations typical of earlier scavenging models. The first working PLUVIUS code was formulated at Stockholm University in 1979. Since that time a number of improved versions have evolved, which have been applied both for data interpretation and field-study design. At present two such versions have been documented in user-manual form for extended scientific applications. 5 references, 4 figures, 1 table.

34245 **(STF—21A83056) Characterization of effluents from coal and oil heating. 3. Oil heated installations.** Vassbotn, T.; Hagen, R.I.; Tellugen, S.; Wiig, P.O. (Trondheim Univ. (Norway). Vassdrags- og Havnelaboratoriet). Mar 1983. 24p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751028.

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Measurements and analyses of effluents were carried out to determine the amount of gas, and SO_2 concentration. Content of polycyclic aromatic hydrocarbons (PAH) in dust and in the exhaust gases. Particle size distribution and heavy metal concentration (i.e., nickel and vanadium), were determined in three dust fractions in the oil and correlated with operational data. Two burners were studied, one heated by heavy oil and the other by light oil. The amounts of dust and SO_2 in the exhaust gases were small. The dust was divided in a "light" and a "dark" type. The darker type consisted of larger particles. The medium size particles had the highest heavy metal concentration. Nickel and vanadium seem to be located in a certain type of dust. These tendencies were clearer for the heavy oil boiler. The amount of PAH in the dust is smaller than for coal heated boilers. 1 drawing, 13 tables.

34246 **(SVC—83-38) Cr(VI) and other metallic mutagens in fly ash and welding fumes.** Stern, R.M.; Thomsen, E.; Furst, A. (Svejsecentralen, Glostrup (Denmark)). 1983. 27p. (CONF-8309223—1). Svejsecentralen, Glostrup, Denmark. Order Number TI84751001.

From 1. international workshop on carcinogenic and/or mutagenic metals; Geneva, Switzerland (11 Sep 1983).

Particulate samples taken from both the indoor (working) and outdoor (community) environments contain a wide range of metallic trace elements most of which are mutagenic in at least one of the short term tests for genotoxicity currently in use. Because of the demonstrated presence of a short lived biologically active species (Cr(VI)) and because the uncertainty with which the results of the screening of metallic compounds in short term tests can be interpreted in terms of human risk, great care must be taken to assure the appropriate collection and storage as well as the chemical and biological assay of such material. The sensitivity of the results for fly ash and welding fumes to variations in these protocols is demonstrated and discussed.

34247 **Role of cloud dynamics in redistributing pollutants and the implications for scavenging studies.** Isaac, G.A.; Strapp, J.W.; Wiebe, H.A.; Leaitch, W.R.; Kerr, J.B.; Anlauf, K.G.; Summers, P.W.; Macpherson, J.I. (Atmospheric Environment Service, Downsview, Ontario; National Aeronautical Establishment, Ottawa, Ontario). pp 1-14 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

There are few field measurements of cloud dynamics-pollutant interactions. This paper describes measurements illustrating the role of clouds in pollution transport. Some discussion of the importance of cloud dynamics is provided. 5 references, 9 figures, 1 table. (MDF)

34248 **Studies of the gas- and aqueous-phase composition of stratiform clouds.** Daum, P.H.; Schwartz, S.E.; Newman, L. (Brookhaven National Lab., Upton, NY). pp 31-52 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). Contract AC02-76CH00016.TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The chemical composition of liquid water and interstitial trace gases and aerosols was measured in stratiform clouds. The cloudwater pH was between 3 and 4 with much of the acidity due to SO_4. Cloudwater was significantly more acidic than clear-air aerosol. Values of the relative acidity of aerosols ranged from 0.1 to 0.6, while cloudwater ranged between 0.6 and 1.1. The acidification process, SO_2 or NO/sub x/ dissolution, was important. Composition of cloudwater samples was due to cloud liquid water content and the concentrations of trace gases in the interstitial cloud air. Interstitial aerosol components were low in comparison to concentrations in cloud water. Composition of interstitial aerosol exhibited a lower acidity than cloudwater. The concentrations of interstitial trace gases were as follows: insoluble gases, NO/sub x/ and O_3 were similar to clean air; soluble gases, HNO_3 and NH_3 were not detected; and moderately soluble gases such as SO_2 were found in some samples. Cloudwater measurements of H_2O_2 suggest that it is present in sufficient amounts to cause rapid conversion of SO_2 to sulfuric acid and may be a major pathway for the production of acids deposited in precipitation. 15 references, 5 figures, 3 tables.

34249 **Measurements of scavenging and transformation of aerosol inside cumulus.** Leaitch, W.R.; Strapp, J.W.; Wiebe, H.A.; Isaac, G.A. (Atmospheric Environment Service, Downsview, Ontario). pp 53-70 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The results of two aircraft studies (fall, 1981 and summer, 1982) designed to provide the beginnings of a data base for the examination of aerosol and gas interactions with clouds are presented. Specifically the behaviour of sulfate in non-precipitating cumulus type clouds and in the surrounding air is investigated with some emphasis placed on the cloud and aerosol properties. Also discussed are problems which may lead to erroneous interpretations when the collected information is insufficient. 11 references, 5 figures, 2 tables.

34250 **Preliminary measurements of the size distribution of cloud interstitial aerosol.** Radke, L.F. (Univ. of Washington, Seattle). pp 71-78 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Preliminary measurements of cloud interstitial aerosol indicate that most of the aerosol number (and much of the aerosol mass) at cloud base is immediately incorporated into cloud water just above cloud base by nucleation scavenging. Thus the rate-limiting, in-cloud scavenging step, is the removal of cloud droplets as precipitation, rather than the inclusion of aerosol into cloud droplets. It is also clear that, for the cases considered, nucleation scavenging bridged the precipitation scavenging gap by rapidly removing aerosol in the 0.01-1 μm size interval. 5 references, 2 figures, 1 table.

34251 **Preliminary measurements on the scavenging of sulfate and nitrate by clouds.** Hegg, D.A.; Hobbs, P.V. (Univ. of Washington, Seattle). pp 79-89 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Preliminary field measurements of the total in-cloud scavenging efficiency for sulfate in cumulus, stratocumulus and stratus suggest that the nucleation scavenging efficiency for sulfate is (63 +- 53)%. Our field measurements also suggest that, unlike sulfate, there is little production of nitrate in cloud droplets and therefore the primary mechanism for the incorporation of nitrates into cloud water is through scavenging of pre-existing nitrates. 21 references, 1 table.

34252 Cloud water chemistry at Whiteface Mountain. Kadlecek, J.; McLaren, S.; Camarota, N.; Mohnen, V.; Wilson, J. (State Univ. of New York, Albany). pp 103-114 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Analyses performed on a few of the events monitored at Whiteface Mountain during the summers of 1980-1982 are discussed. The purpose of the experiment was to monitor the concentrations of the dominant ions throughout the cloudy events. This was done for about 10 events each summer. Samples of cloud water were refrigerated immediately after collection and ion chromatography measurements were made within one day. 5 references, 5 figures, 2 tables.

34253 Dependence of sulphate scavenging ratios on meteorological variables. Barrie, L.; Neustadter, J. (Atmospheric Environment Service, Downsview, Ontario). pp 203-216 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The usefulness of a large data base and statistical analysis techniques in separating a signal representing the relationship between the daily sulfate scavenging ratio (W) and meteorological factors from measurement noise associated with the estimation of W by ratios measured at a point on the ground is illustrated. In eastern Canada, W depends on several variables which, in order of importance are: precipitation amount, location and precipitation type. On the basis of ground level observations no dependence of W on cloud type was apparent. The fact that a substantial fraction of the variance in W remains unexplained by meteorological variables leads to the conclusion that the accuracy of a sulfate deposition estimate based on the equation given will improve as averaging time increases. Consequently, predictions of seasonal or annual sulfate deposition will be more accurate than those for single events. A comparison of sulfate and particle scavenging ratios to deduce the mean contribution of SO_2 oxidation to sulfate wet deposition (70 +- 30%) illustrates the value of routine ground level measurements in providing insight into atmospheric transformation processes. 12 references, 2 figures, 2 tables.

34254 Scavenging ratios for exceptional wet $SO_4$2p episodes in eastern North America from three event networks. Niemann, B.L. (Univ. of Illinois, Urbana). pp 217-228 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

This paper analyzes the scavenging ratios for exceptional wet SO_4 episodes from three event networks in eastern North America. Data from APN, EPRI-UAPSP and MAP3S networks were used. Data show considerable temporal and spatial variability from site-to-site and from year-to-year. The scavenging ratios for exceptional episodes appear to be independent of precipitation rate or amount, a result which has been found previously for the high precipitation rates usually associated with the exceptional episodes. 8 references, 4 figures.

34255 Correlation of intrastorm sequential precipitation chemistry with storm meteorology. Wilson, J.; Graham, R.; Robertson, J. (Science Research Lab., West Point, NY). pp 229-238 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Sequential sampling of increments of 0.01 inch has been shown to be an effective method to examine detailed variations in precipitation chemistry for a variety of meteorological conditions. Resolution on this scale allows for accurate correlation of precipitation chemistry with storm types, accompanying meteorological data, and trajectory analysis. Often even event-only sampling cannot be accurately correlated with meteorological data due to a complex series of weather phenomenon. The described automated sampler provides a reliable method for collection of these samples. The detailed chemical data set obtained through sequential sampling may also be utilized to develop integrated values for the entire event. Total cumulative deposition is only one example of this technique. 4 references, 6 figures, 1 table.

34256 Tracking the source regions for wet deposition in the Netherlands by a combination of cluster analysis and meteorological interpretation. Slanina, J.; Asman, W.A.H. (Netherlands Energy Research Foundation, Petten; Inst. for Meteorology and Oceanography, Utrecht, Netherlands). pp 239-248 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Statistical techniques have been used to classify precipitation sampling periods on the basis of chemical composition. Cluster analysis (centroid method) using concentrations of 12 or 9 compounds per sampling period had no effect on groups. The analysis divided the data into 2 source groups, continental origin and marine origin. The contribution of HNO_3 and H_2SO_4 to the acidity of rain was investigated using multiple regression analysis on the data from each group. In many cases the role of HNO_3 was more important. 5 references, 5 figures, 3 tables.

34257 Scavenging of nitric acid vapor by snow. Huebert, B.J.; Fehsenfeld, F.C.; Norton, R.B.; Albritton, D. (Colorado Coll., Colorado Springs; Aeronomy Lab., NOAA/ERL, Boulder, CO). pp 293-302 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Nitric acid vapor is rapidly scavenged from the atmosphere by falling snow. It appears that this process occurs with a rate constant about five times as fast as the incorporation of aerosol NO_3^- or SO_4^{2-} into snow. Table 2 lists our best estimates of both scavenging coefficients and washout ratios, although we feel that the nitric acid scavenging coefficient should be treated as a lower limit to the true value. We also found that nitric acid contributes about one-half of the acidity deposited in snowfall at this mountain site. 17 references, 2 tables.

34258 Scavenging measurements near large point sources: a review and evaluation. Dana, M.T.; Patrinos, A.A.N. (Pacific Northwest Labs., Richland, WA; Brookhaven National Lab., Upton, NY). pp 335-348 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). Contract AC06-76RL01830.TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

This review has been confined to open literature reports and recent work on the subject of large point-source scavenging measurements. From this body of work, it appears that the available experimental results are limited to a few specific sources and deal in detail with few precipitation events. Observed concentrations of the major scavenged species vary considerably, presumably as a result of variations in meteorological and background conditions and source characteristics, but often insufficient detail is given (or measured) to evaluate useful scavenging parameters. The results from low background studies indicate that SO_2 scavenging is a significant contributor to the rather low sulfur deposition impact close to the source, but it is not clear that these results can be applied to high-background conditions, because of the potential for modified SO_2-sulfate reaction rates, and the lack of sampling to great distances. Assistance in resolving questions of the impact of within-region sources on regional precipitation chemistry may be provided by further study of the original data of past efforts, particularly the recent Sudbury studies. Otherwise, new field efforts in high background areas, employing modern analytical and plume-sensing techniques, and sampling to greater distances, are required. 20 references, 3 tables.

34259 Estimation of wet deposition from a plume of a powerplant and of the corresponding background concentration. Slanina, J.; Romer, F.G.; Asman, W.A.H. (Netherlands Energy Research Foundation, Petten; KEMA Labs. Environmental Dept., Arnhem, Netherlands; Inst. for Meteorology and Oceanography, Utrecht, Netherlands). pp 349-356 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Wet deposition of plume constituents were measured and multiple regression analysis used to achieve background correction and data validation. Samples were collected using arcs containing 30 samples located 5 and 15 km from an oil fired power station near Lelystad, The Netherlands. All compounds washed out with the same efficiency. Using this data, background concentrations of sulfate were calculated and compared to measured concentrations of background sulfate. The resulting ratios (between 0.9 and 1.1) were used to validate the data and to calculate the contribution of background sulfate to sulfate deposition under the plume. 5 references, 4 figures, 2 tables.

34260 Scavenging rates of sulfur and trace metals from a smelter plume. Lusis, M.A.; Chan, W.H.; Tang, A.J.S.; Johnson, N.D. (Ontario Ministry of the Environment, Toronto; Ontario Research Foundation, Mississauga). pp 369-382 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The scavenging rates of sulfur and trace metals from the emissions of the INCO smelter at Sudbury, Ontario, have been studied during a number of storms. In spite of a considerable difference in the particle size distributions of the trace metals, comparable scavenging coefficients were observed. This is attributed largely to in-cloud modifications of the emitted particulate matter. The scavenging rate of sulfur from the plume was more than an order-of-magnitude lower than that for the trace metals. This results from the fact that, within the acidic environment of the plumes studied here, little SO_2 is dissolved in rain- or cloud-drops, and removed by precipitation. Most of the sulfur is thought to be removed as sulfate at the distances from the source studied here. During the summer months, secondary sulfate formation may play a more important role. No definite influence of meteorological factors, such as precipitation type or rate, could be discerned in the present data set. It should be noted that most of the storms studied here were frontal storms as the present approach is not feasible for convective storms. The scavenging coefficients determined in this study should be of value for mathematical modelling applications, especially for releases from elevated sources during frontal storms. 16 references, 2 figures, 2 tables.

34261 Precipitation scavenging and dry deposition of pollutants from the inco nickel smelter in sudbury. Chan, W.H.; Ro, C.U.; Vet, R.J.; Tang, A.J.S.; Lusis, M.A. (Ontario Ministry of the Environment, Toronto, Ontario; Petro-Canada, Alberta; Concord Scientific Corp., Downsview, Ontario). pp 383-394 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Precipitation and air monitoring data collected from mid-1978 to mid-1980 were used to evaluate the fate of INCO emissions. It was found that INCO, on average, contributed less than 20% of the Sudbury Basin wet deposition of sulfur, acidity and a number of trace metals, with the exception of copper and nickel, where the contribution was about 70%. It was estimated that of sulfur dioxide, and substances predominantly in submicron particles (sulfate, lead, zinc and cadmium) less than 5% of the emissions were dry deposited within 40 km of the INCO source, whereas for coarse particles (containing most of the iron, nickel and copper) 50% or more of the emissions were deposited within this distance. The smelter contribution to the total dry deposition within 40 km of the source was the greatest for sulfur and nickel. The smelter contribution to the other metals examined (iron, lead, zinc, cadmium, aluminum) was generally less than 20% of the total dry deposition. 14 references, 4 tables.

34262 Distribution of polycyclic aromatic hydrocarbons in precipitation. Georgii, H.W.; Schmitt, G. (Univ. of Frankfurt, Germany). pp 395-402 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Rain samples collected from January to June 1981 exhibited seasonal variation in PAH concentration with a winter maximum and a summer minimum. The same variation was found in aerosol-bound PAH. A strong correlation between PAH-concentration and atmospheric temperature was observed. There is also a temporal trend during individual events as the PAH concentration decreases with time, the unsoluble fraction showing a rapid drop during the initial phase while the soluble fraction remains steady. Snowfall events were used to study the regional distribution of PAH in precipitation. The highest concentrations occurred in urban areas decreasing toward suburban and rural environments. In addition, the insoluble and soluble fractions are equal in suburban sites while the insoluble fraction exceeds the soluble in the city. A comparison between atmospheric aerosol particles and precipitation samples shows that the precipitation samples are enriched in species of low molecular weight. 7 references, 3 figures, 1 table.

34263 Organic compounds in Los Angeles and Portland rain: identities, concentrations, and operative scavenging mechanisms. Pankow, J.F.; Isabelle, L.M.; Asher, W.E.; Kristensen, T.J.; Peterson, M.E. (Oregon Graduate Center, Beaverton). pp 403-416 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The rain sampling/analysis methodology employed attempts to distinguish between the dissolved and scavenged particle-associated levels of a variety of organic compounds. For many of the PAH compounds studied, the total (dissolved and filterable) concentration was of the order of 1 to 200 ng/L. Thus, even though the heavier PAH compounds will tend to be scavenged more effectively (they are associated with the aerosol particles to a greater extent), it would seem that their decreasing contribution to the total PAH levels provides a counterbalance leading to a more evenly distributed total flux rate. Concentrations determined for the Portland storm event indicate that the dissolved flux rates can be: relatively high for many of these compounds; and possibly underestimated if calculated on the basis of near ground-level atmospheric gas concentrations. 20 references, 1 figure, 5 tables.

34264 Effects of organic surface films on the scavenging of atmospheric gases by raindrops and aerosol particles. Graedel, T.E.; Gill, P.S.; Weschler, C.J. (Bell Labs., Holmdel, NJ). pp 417-430 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A review of information pertaining to the presence of organic films on atmospheric water droplets suggests that such films are common on atmospheric aerosol particles and may sometimes be present on raindrops as well. Some consequences of the presence of organic films were investigated by kinetic calculations of the chemistry of film-coated and uncoated raindrops. Species whose concentrations in the drops are controlled by incorporation from the gas phase are markedly affected if an organic film is present. Those which are present within cloudwater prior to the formation of raindrops or which are chemically generated within raindrops are influenced to a much smaller degree by the presence of an organic film. Organic films on atmospheric water droplets therefore do not have the potential to shut down all chemistry with droplets, but only specific aspects of that chemistry. 13 references, 4 figures, 1 table.

34265 Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). 725p. (CONF-821136—Vol.2). Elsevier Science Publishing Co., Inc., 52 Vanderbilt Avenue, New York, NY 10017. Order Number TI84002448.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Volume 2 of these proceedings contains papers on dry deposition and resuspension of airborne pollutants. Items within the scope of EDB have been entered separately into the data base. (ACR)

34266 Deposition and resuspension. Chamberlain, A.C. (AERE, Harwell, England). pp 731-751 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The deposition, resuspension and washout of gases and particles were discussed. Specific areas presented include: an historical background; transport by molecular and Brownian diffusion to surfaces; deposition of particles in the 0.2 to 2.0 μm size range and the 2.0 to 30.0 μm size range; deposition of polydisperse particles in the field; and resuspension. 108 references, 6 figures.

34267 Dry deposition of sulphur dioxide onto grass in rural eastern England (with some comparisons with other forms of sulphur deposition). Davies, T.D.; Mitchell, J.R. (Univ. of East Anglia, Norwich, England). pp 795-806 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The dry deposition of SO_2 over grass, calculated from measurements made over periods of several hours, day and night, during relatively constant atmospheric conditions, for a period June-February is discussed. Results show a reduced resistance of wet grass surfaces to SO_2 deposition. 29 references, 2 figures, 3 tables.

34268 Development of an instrument package for the measurement of dry deposition fluxes by eddy correlation. Edwards, G.C.; Ogram, G.L. (Ontario Hydro Research, Toronto). pp 817-824 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The objective of this research is to develop an instrument package for the measurement of dry deposition fluxes using eddy correlation techniques. The successful application of the eddy correlation method requires simultaneous measurement of gas concentration and vertical air motion. A significant problem is the measurement of trace gas concentration fluctuations with sufficient sensitivity and time response. The central aspect of the work will be the development and evaluation of a tunable diode laser absorption spectrometer (TDLAS) system to make fast response (~ 10 Hz), high sensitivity, (<1 ppB) measurements of the concentrations of various gases of interest (e.g., NO, NO_2, NH_3, HNO_3, SO_2, O_3). To complement the laser system a comprehensive micrometeorological instrument package is being assembled. This will include two sonic anemometers, two Lyman-Alpha hygrometers, a 3-component hot film anemometer, micro-bead thermistor sensor, covariance flux meter and data logger/minicomputer. Under ideal circumstances the instrument package will facilitate the measurement of mean turbulent properties at three levels and pollutant flux at one level within the surface layer. Eddy correlation experimental and data analysis techniques will follow those commonly used by previous researchers. 5 references, 3 figures.

34269 Deposition of atmospheric trace constituents onto different natural surfaces. Hoefken, K.D.; Meixner, F.X.; Ehhalt, D.H. (Atmosphaerische Chemie der Kernforschungsanlage, Juelich, Germany). pp 825-835 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

An extended field study of the deposition of airborne constituents upon study of the deposition of airborne constituents upon natural surfaces was studied. A forested area was chosen for two reasons: the forest represents one of the largest natural surfaces; and deposition of trace constituents is considered to be responsible for severe damages to the forest ecosystems themselves. Recent investigations show that vegetation is an important sink for atmospheric trace constituents. 11 references, 7 figures, 2 tables.

34270 Dry deposition of small particles to grass in field conditions. Garland, J.A. (AERE, Harwell, England). pp 849-858 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Recent field measurements of the deposition velocity of small particles have been discussed and some available measurements in the literature are reviewed. The recent measurements are broadly consistent with the variation of deposition velocity with particle size determined in wind tunnel measurements. Deposition of trace elements to filter pads in the field is several times larger than expected; some of the discrepancy may be explained by the characteristics of the sampling method used. Hygroscopic growth of micron-sized particles of substances such as sodium chloride and ammonium sulphate may sometimes explain a doubling of deposition to smooth wet surfaces, but a smaller enhancement of deposition is expected for wet grass surfaces. 25 references, 2 figures, 4 tables.

34271 Dry deposition of trace elements in Olympic National Park. Davidson, C.I.; Goold, W.D.; Wiersma, G.B. (Carnegie-Mellon Univ., Pittsburgh, PA; EG & G Idaho, Inc., Idaho Falls). pp 871-882 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Airborne trace elements in Olympic National Park are derived from a multiplicity of sources, incluing soil dust, sea spray, and anthropogenic emissions. Soil dust appears to be the dominant source for many elements. Some elements characterized by large enrichment factors may be emitted from distant anthropogenic activities and transported over great distances into the Park. Dry deposition fluxes measured on Teflon plates suggest that a small fraction of large airborne particles may be responsible for most of the deposition of each trace element. Material reaching the plates is probably local soil dust and biological debris; particles which have been previously transported into the Park, deposited on soil and vegetation, and later resuspened are also included in the plate deposits. These successive deposition-resuspension processes make it extremely difficult to accurately assess dry deposition of aerosol brought into the Park from other areas. Proper estimates of dry deposition require samplers above the layer of resuspended surface material.

34272 Comparison of surrogate surfaces for dry deposition collection. Dasch, J.M. (General Motors Research Labs., Warren, MI). pp 883-902 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

An initial attempt to compare a variety of surfaces for dry deposition collection is presented. Many of these surfaces were used in the past with the assumption that any surface could collect dry deposition. This study shows that there is a large range of collection efficiencies between surrogate surfaces, as there is for natural surfaces. In general, the surfaces ranged over a factor of 10 from most-to-least effective. The collection efficiency could be explained by surface roughness for particles and surface alkalinity for gases. The metals and sulfate and nitrate showed similar behavior on the various surfaces. The exception is the alkaline glass filter which collected higher nitrate and sulfate than the other surfaces, presumably due to gaseous adsorption. A comparison of material collected on upward and downward surfaces indicated that gravitational settling was the most important removal mechanism. However, gaseous adsorption to the alkaline glass filter accounted for at least 43% of nitrate and 75% of sulfate collection. The polyethylene bucket, collected more material than the Teflon and foils, but less than nylon, quartz, glass, or water. Deposition to the bucket is probably dominated by the gravitational settling of large particles and apparently is not influenced by gaseous deposition. The bucket may grossly underestimate dry deposition. 12 references, 4 figures, 5 tables.

34273 Relationship between dry deposition as measured via collection with a dry bucket vs ambient air concentrations. Johannes, A.H.; Altwicker, E.R. (Rensselaer Polytechnic Inst., Troy, NY). pp 903-912 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Fluxes measured using dryfall buckets are compared with fluxes calculated using measured ambient air concentrations of sulfate and nitrate aerosols. Weekly, monthly and seasonal fluxes were calculated using deposition velocities for one year. 6 references, 6 tables.

34274 Accumulation rates of ionic substances on indoor surfaces. Sinclair, J.D.; Psota-Kelty, L.A.; Munier, G.B. (Bell Telephone Labs., Holmdel, NJ). pp 913-931 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Results of sampling ionic substance deposition from 36 different equipment sites in 18 different cities are summarized. Data are interpreted and compared to available trophospheric data. 14 references, 3 figures, 15 tables.

34275 Experimental study of sulfur deposition to grassland. Hicks, B.B.; Wesely, M.L.; Coulter, R.L.; Hart, R.L.; Durham, J.L.; Speer, R.E.; Stedman, D.H. (NOAA/ATDL, Oak Ridge, TN; Argonne National Lab., IL; Environmental Protection Agency, Research Triangle Park, NC; Univ. of Michigan, Ann Arbor). pp 933-942 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Independent measurements of the deposition of gaseous and particulate sulfur compounds were measured over a field of wheat stubble overgrown with grassy weeds. Sulfate particle and SO_2 flux measurement indicate greater deposition velocities for SO_2 than for particulates. Sulfate aerosol deposition declined at night. Derived daytime deposition velocity for SO_2 deposition was about 0.8 cm/s nighttime deposition declined to 0.2 cm/s. For particulate sulfur, daytime deposition velocities were 0.7 cm/s and at night near 0.2 cm/s. 11 references, 1 figure, 1 table.

34276 Size-resolved measurements by eddy-correlation of the dry deposition velocity of atmospheric aerosol particles. Katen, P.C.; Hubbe, J.M. (Oregon State Univ., Corvallis). pp 953-962 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A portion of the data collected during DIEX was used to make a preliminary evaluation of the usefulness of the PMS ASAS-300A and Royco 225 sensors for making eddy-correlation measurements and to characterize the nature of the deposition process. Fast Fourier transform (FFT) routines are used to determine the spectral characteristics of the signals. A preliminary evaluation of the transport process is discussed and recommendations for establishing sampling criteria are given. 12 references, 7 figures.

34277 **Eddy flux and profile measurements of small-particle dry-deposition velocity at the Boulder Atmospheric Observatory (BAO).** Sievering, H. (National Oceanic and Atmospheric Administration, Boulder, CO). pp 963-978 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Due to possible confounding of earlier results by resuspension of surface particles, a deposition measurement program was designed to obtain v/sub d/ (deposition velocity) during reduced surface source (May-wet soil) and enhanced surface source (August-dry soil) conditions. The eddy correlation technique, using a Knollenberg ASAX probe with a 10 Hz sampling rate and sizing particles in te range $0.09 < D < 2.5$ μm was used in conjunction with the particle sampler elemental profile approach. Thus, a particle size related v/sub d/ and a trace-element-inferred v/sub dH/ may be compared. 10 references, 5 figures, 4 tables.

34278 **Comparison of several techniques for determining dry deposition flux.** Sickles, J.E. II; Bach, W.D.; Spiller, L.L. (Research Triangle Inst., Research Triangle Park, NC; Environmental Protection Agency, Research Triangle Park, NC). pp 979-989 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Simultaneous monthly estimates of dry deposition flux of nitrates and sulfates over a year's duration by several methods were determined and results compared. Direct estimates were made by using actual leaf surfaces ad foliar wash and by using three surrogate surfaces: bucket, petri dish, and cellulose filter. Indirect estimates were made using the concentration determined by sampling and by using the deposition velocity estimated from meteorological measurements. 6 references, 1 figure.

34279 **Estimation of dry deposition velocities of sulfur over Canada and United States east of the Rocky Mountains.** Masse, C.; Voldner, E.C. (Service de l'Environnement Atmospherique, St-Laurent, Montreal; Atmospheric Environment Service, Downsview, Ontario). pp 991-1002 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The monthly average dry deposition velocity fields of sulfur dioxide and sulfate in North America east of the Rocky Mountains were estimated. The estimates are projected on the Canadian Meteorological Centre grid system with a 1/3 grid length (127 km) resolution. The estimates are based on a method developed by Sheih. Extensions to or deviations from Sheih's approach are discussed. Required input data, such as land use and meteorological data base are indicated and results summarized. 17 references, 2 figures, 4 tables.

34280 **Profiles of elements in the surface boundary layer.** Doran, J.C.; Droppo, J.G. (Battelle, Pacific Northwest Labs., Richland, WA). pp 1003-1012 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A series of profile measurements of several elements has been made using x-ray fluorescence to determine concentrations on filters placed at heights of 0.75, 1.5, 3.0 and 6.0 m. For sulfur, relative accuracies of 4% or better were obtained among the concentrations on the filters for a given sampling period. This accuracy allowed deposition velocities in the range of 0.2 to 0.3 cm s^{-1} to be resolved under the experimental conditions encountered. A number of profiles were obtained that provided an upper bound of v/sub d/ in the range of 0.3 to 0.4 cm s^{-1}. No evidence was found for some of the larger values of v/sub d/ reported elsewhere. Kinked profiles were found to be associated with meteorological conditions that were not appropriate for the application of gradient transport theory to the analysis of pollutant flux. 13 references, 6 figures.

34281 **Universal model for entrainment processes.** Kyaw Tha Paw U. (Purdue Univ., West Lafayette, IN). pp 1111-1120 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

It is shown that wind erosion, entrainment and reentrainment of particles, whether they be soil particles, spores and pollen, or inorganic particles, may be described by a single stochastic model for the occurrence of sweeping eddies. This model was developed for particle reentrainment within wind tunnel and pipe flow by Cleaver and Yates, but seems conceptually and quantitatively similar to reentrainment phenomena at the atmosphere-surface interface, assuming no saltation. Further development of this model is suggested with the inclusion of saltation processes, and with special emphasis on the physics of the atmospheric surface boundary layer and rebound-net deposition phenomena. 22 references, 1 figure.

34282 **Correction to the Gaussian source-depletion model.** Horst, T.W. (Pacific Northwest Lab., Richland, WA). pp 1205-1218 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A correction has been proposed to the Gaussian source depletion model to account for alteration of the vertical distribution of contamination caused by deposition at the surface. The computational requirements of the corrected source depletion model are equivalent to those of the unmodified source depletion model. Considering the assumptions on which the correction is based, the proposed model is expected to predict best the near-surface airborne concentration and the suspension ratio, particularly for σ/sub z// $h > 1$. These predictions, as well as the vertical concentration profile up to a height of $z \simeq \sigma$/sub z/, were shown to compare quite well with those of an exact technique to account for deposition from a Gaussian plume. 15 references, 3 figures.

34283 Estimates of dry and wet deposition and resuspension fluxes of several trace metals in the Southern Bight of the North Sea. Dedeurwaerder, H.L.; Dehairs, F.A.; Decadt, G.G.; Baeyens, W.F. (Vrije Univ., Brussels, Belgium). pp 1219-1231 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Air-sea exchanges in the Belgian coastal area located in the Southern Bight of the North Sea were studied. Since 1980 the tropospheric aerosol contents for the trace elements Cd, Cu, Mn, Pb, Zn and for the reference elements Al, Fe, Na have been monitored on an intermittent basis from a maritime sampling platform (Light-Vessel West-Hinder; position: 51°23.5'N-02°21.5'E). During 1981 sampling at sea was paralleled by sampling on land, in the coastal area (natural reserve De Blankaert, located at 20 km inland), in order to allow for a better evaluation of the specific source or sink role of the sea. No major source of pollution exists between the maritime and the continental sampling sites. During these simultaneous land-sea campaigns dry deposition and rainwater were sampled, besides aerosols. Furthermore, the sea surface microlayer and the watercolumn in the vicinity of the Light-Vessel were investigated for possible enrichments and in order to allow an estimation of the resuspension flux. 9 references, 2 figures, 5 tables.

34284 Influence of relative humidity and sea salt nuclei on the eddy flux determination of small particle dry deposition over the sea. Schmidt, J.; Eastman, J.; Sievering, H. (Univ. of Wisconsin, Madison; Governor's State Univ., Park Forest South, IL). pp 1233-1242 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The transport rates of submicron particles both into and out of the sea are of particular interest to marine atmospheric scientists and extremely difficult to determine. Recently developed particle counting instruments have made possible the use of eddy correlation methods which offer what is probably the only in situ measure of these fluxes. Results of some particle eddy correlation (or eddy flux) measurements over the sea at a nearshore site are evaluated in terms of measurement problems related to the high humidity over water and the rate of small particle sea salt production. 12 references, 5 figures, 1 table.

34285 Estimation of the dry deposition velocity and scavenging ratio for organic chemicals. Tucker, W.A.; Lyman, W.J.; Preston, A.L. (Arthur D. Little, Inc., Cambridge, MA). pp 1243-1257 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A method for estimating the deposition velocity (order-of-magnitude accuracy) and precipitation scavenging ratio for a range of organic compounds is presented. Climatological mean deposition properties used were characteristic of the atmospheric boundary layer representing conditions over the continental US. Deposition of trace organics is controlled by interfacial resistance rather than turbulent boundary layers, muting the effect of meteorological controls. 33 references, 6 tables.

34286 Size distribution and mineralogy of aluminosilicate dust particles in tropical Pacific air and rain. Buat-Menard, P.; Ezat, U.; Gaudichet, A. (Centre des Faibles Radioactivites, Gif-sur-Yvette, France; Universite de Paris XII, France). pp 1259-1269 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Microscopic investigations of the size distribution and the mineralogy of individual aluminosilicate particles collected by bulk filtration of air and rain in the remote marine atmosphere were done. Such particles are almost completely insoluble in rainwater and provide a direct estimate of wet removal efficiencies as a function of particle size. 18 references, 2 figures, 4 tables.

34287 Snow crystal riming and arctic snowpack chemical composition. Borys, R.D. (Colorado State Univ., Fort Collins). pp 1281-1288 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Ice core and snowpack chemical constituents in the Arctic have been used as a historical record of atmospheric chemical composition based on the assumption that there is no chemical fractionation between aerosol particles and snow crystals. Recent measurements show ice and snow chemical compositions do not reflect the overlying aerosol particle chemical composition. It is suggested that a lack of ice crystal riming in arctic snowfalls could explain the differences between snowpack and aerosol chemical constituents. Hence, ice core and snowpack chemical constituents may be poor indicators of past and present arctic aerosol chemical composition. 19 references, 3 figures.

34288 Trace gases in snow and rain. Rasmussen, R.A.; Khalil, M.A.K.; Hoyt, S.D. (Dept. of Environmental Science, Beaverton, OR). pp 1301-1314 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Concentrations in snow and rain of 3 man-made gases (CCl_3F, CCl_4, CH_3CCl_3) and 3 gases with established oceanic sources (CH_3I, $CHCl_3$, N_2O) were studied. The snow and rain samples wer not enriched in anthropogenic gases, but were enriched in CH_3I and $CHCl_3$. The N_2O data were variable and were insufficient to establish whether rain or snow is enriched. 20 references, 4 figures, 2 tables.

34289 Global cycle of particulate elemental carbon: a theoretical assessment. Turco, R.P.; Toon, O.B.; Whitten, R.C.; Pollack, J.B.; Hamill, P. (R & D Associates, Marina del Rey, CA; NASA Ames Research Center, Moffett Field, CA; San Jose State Univ., CA). pp 1337-1351 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Scienee Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Present understanding of the global elemental carbon cycle appears to be reasonably well-founded in observational data and scientific principles. The emission rates of particulate EC are consistent with measured concentrations in the atmosphere and removal rates based on dry and wet deposition. Detailed microphysical

simulations are capable of explaining many of the observed features of the EC cycle and may be used to predict the source/sink relationships and environmental consequences of anthropogenic carbon emissions. On a global scale, elemental carbon is a trace (≦ 5%) component of the background aerosols, and plays only a minor role in the oxidation of atmospheric sulfur compounds to sulfate. On the other hand, sunlight absorption by particulate elemental carbon may produce significant heating of the atmosphere. Elemental carbon may also cause important changes in atmospheric composition, visibility and thermal stability on regional and urban scales. 63 references, 6 figures, 4 tables.

34290 **Suggestions for further research.** Georgii, H.W. pp 1417-1419 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Areas identified for future research are identified and briefly discussed. Topics presented include: heterogenous oxidation of SO_2; cloud-water studies; scavenging by ice-crystals and organic compounds in cloud and rain drops.

34291 **Comments about precipitation scavengging research.** Rodhe, H. (Univ. of Stockholm, Sweden). pp 1421-1423 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Comments are provided on the following three sessions; mountain studies, plume studies and in-cloud scavenging.

34292 **Overview and suggestions for future research on dry deposition.** Hicks, B.B.; Garland, J.A. (National Oceanic and Atmospheric Administration, Oak Ridge, TN; Atomic Energy Research Establishment, Harwell, England). pp 1429-1433 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A brief overview of dry deposition is presented. Subjects discussed include: deposition of trace gases; deposition of particulates; culfate deposition; ozone; nitrogen dioxide and sampling techniques. Future research is also discussed.

34293 **Monitoring ambient air for mutagenicity using the higher plant Tradescantia.** Schairer, L.A.; Sautkulis, R.C.; Tempel, N.R. (Biology Dept. Brookhaven National Lab. Upton, NY). pp 123-140 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—).

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter examines somatic mutation in the Tradescantia stamen hair. Discusses the stamen hair system; radiobiology; chemical exposures under lab conditions; chemical exposures under field conditions (ambient air); results of in situ exposures to ambient air; and the relevance of the stamen hair system to environmental mutagen assessment. Shows how the high sensitivity and versatility of the Tradescantia stamen hair system were put to good use by employing the plant as an in situ monitor for mutagens in ambient air in polluted industrial sites. Finds that the environment most consistently mutagenic was that downwind from petroleum refineries. Concludes that the most unique asset of the plant is its ability to respond to low levels of airborne compounds. Encourages the greater use of radiobiological data. Points out that the predictive potential for the effects of environmental mutagen agents is important with regard to earlier studies related to nuclear fallout and its impact on ecology (the food chain in particular).

34294 **Problems associated with assessing the mutagenicity of inhalable particulate matter.** Raabe, O.G. (Lab. for Energy-Related Health Research Univ. of California Davis, CA). pp 209-223 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—). Contract AC03-76SF00472.

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter attempts to identify and quantify the mutagenic materials associated with airborne particles and provide information, such as mutagen median physical or aerodynamic diameter, in order to evaluate the regional deposition of the particle in the respiratory tract during inhalation by people. Discusses sample collection, particle size considerations, sample fidelity, and mutagenesis testing procedures. The goal is to predict biological fate and carcinogenic or other untoward response. Concludes that analysis methodologies should include detection limits, essential and gross features, data reduction methodologies, key constituents and overall analysis goals. Suggests that chemical identification be made of the mutagenic agents present in samples and in the sampled atmospheres.

34295 **Genetic effects of ethylene dibromide in drosophila melanogaster.** Kale, P.; Baum, J.W. (Safety and Environmental Protection Division Brookhaven National Lab. Upton, NY). pp 291-300 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—). Contract AC02-76CH00016.

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter reports on how ethylene dibromide (EDB) can be used to show that Drosophila can detect concentrations as low as 0.2 ppm in air when exposed for a relatively short period of 11 hrs. Demonstrates the high sensitivity of Drosophila for detection of gaseous mutagens. Points out that low concentrations of gaseous mutagens in ambient air are being studied utilizing a sensitive clone of Tradescantia. Suggests that Drosophila may be extremely useful as a biological monitor to detect airborne genotoxic agents in polluted areas.

34296 **(LA-tr—84-13) Suitability of bees as an indicator for environmental problems.** Drescher, W. Translated from *Decheniana ;* **26**: 171-177(1982). Contract W-7405-ENG-36. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013351. DE84013351

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The hazard, especially in modern agricultural technology, for the ca. 550 Central European species of wild bees is obvious. The lack of sufficient investigations on quantitative values, however, hampers the ecological analysis and the use of these species as bioindicators. While the honey bee, Apis mellifera L., has been thoroughly investigated with respect to its toxicology, its changing population density is much obscured by human care for the colonies and therefore unsuitable for indicator functions of environmental disturbances. Systematic utilization of bee colonies as indicators of industrial emission and radionuclide distribution proved useful for the detection of effects and trends.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 32759, 34169, 34225, 34331, 34365, 34366, 34367

34297 **(DOE/EV/10374—4) Factors controlling indoor radon levels. Annual report, June 1983-May 1984.** Harley, N.H. (New York Univ., NY (USA). Dept. of Environmental Medicine). 31 May 1984. Contract AC02-80EV10374. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012712.

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The factors which contribute to indoor radon levels were investigated. Soil moisture content appears to be such a factor and influences indoor radon levels in a subtle way. The single family dwelling studied here is a typical suburban home, with a full basement, two living levels and a full attic. Seasonal data for 1981 to 1983 are shown by hour (about 90 hours in each average) for the basement, first floor and outdoors. A twenty-five story, 225 apartment, high rise building has been under study for about the same time interval. The apartment has five rooms, and is on the 24th floor. Continuous monitors are located in a work room and outdoors on a terrace. Data are available from the summer of 1981. 2 references, 12 figures, 9 tables.

34298 **(DOE/OR/20722—16) Weldon Spring Site environmental monitoring report, calendar year 1983.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Jun 1984. Contract AC05-81OR20722. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013663.

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During 1983, an environmental monitoring program was continued at the US Department of Energy (DOE) Weldon Spring Site (WSS), located in St. Charles County, Missouri. The monitoring program measures the radon gas content in air, the radium and uranium content of surface water and groundwater, and external radiation levels. The nitrate content of surface water is also measured. Radiation doses to the public from the radioactive residues stored at the site are also calculated. During 1983, site boundary radon concentrations, including radon emanating from naturally occurring sources, were alll below the DOE CG limit of 3 pCi/1. Groundwater uranium and radium-226 concentrations within the controlled site areas were all below the DOE CG limits for uncontrolled areas. During 1983, various maintenance and investigative activities at the WSS have not disturbed and stored radioactive materials. 9 references, 8 figures, 4 tables.

34299 **(DP-MS—84-38) Evaluation of Savannah River Plant emergency response models using standard and nonstandard meteorological data.** Hoel, D.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 14p. (CONF-840612—12). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013146.

From Air Pollution Control Association annual meeting; San Francisco, CA, USA (25 Jun 1984).

Two computer codes have been developed for operational use in performing real time evaluations of atmospheric releases from the Savannah River Plant (SRP) in South Carolina. These codes, based on mathematical models, are part of the SRP WIND (Weather Information and Display) automated emergency response system. Accuracy of ground level concentrations from a Gaussian puff-plume model and a two-dimensional sequential puff model are being evaluated with data from a series of short range diffusion experiments using sulfur hexafluoride as a tracer. The models use meteorological data collected from 7 towers on SRP and at the 300 m WJBF-TV tower about 15 km northwest of SRP. The winds and the stability, which is based on turbulence measurements, are measured at the 60 m stack heights. These results are compared to downwind concentrations using only standard meteorological data, i.e., adjusted 10 m winds and stability determined by the Pasquill-Turner stability classification method. Scattergrams and simple statistics were used for model evaluations. Results indicate predictions within accepted limits for the puff-plume code and a bias in the sequential puff model predictions using the meteorologist-adjusted nonstandard data. 5 references, 4 figures, 2 tables.

34300 **(DPSP—61-25-7) Environmental release of iodine-131, May 29-June 23, 1961.** Reinig, W.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Aug 1961. Contract AC09-76SR00001. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013152.

A release of 153 curies of iodine-131 from Building 291-F stack, most of which was discharged during the period of May 30 through June 3, temporarily caused high concentrations of radioiodine in milk produced in the vicinity of the Savannah River Plant. The consumption of this milk may have resulted in a thyroid dose up to 1260 mrem. The environmental concentrations of radioiodine and the off-Plant exposures resulting from the releases were below the limits established by the National Committee on Radiation Protection. Investigation of the source of the abnormally large amount of radioiodine in the F-Area canyon process was inconclusive but there is a probability that short-cooled uranium was unintentionally dissolved. 6 figures.

34301 **(DPSP—62-25-1-Del.Ver.) 1960 Audit of SRP radioactive waste.** Ashley, C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Feb 1962. Contract AC09-76SR00001. 12p. NTIS, PC A02; 3; GPO Dep. Order Number DE84013366.

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This report summarizes the radioactive waste released to the environs of the Savannah River Plant for the calendar year 1960. In addition, the total quantity of radioactive waste released from start-up of Plant operations through 1960 is summarized. Accuracy is not always implied to the degree indicated by the number of significant figures reported. Values were not rounded since data will be used in future cumulative summaries.

34302 **(DPSP—74-25-1) 1973 releases of radioactivity at the Savannah River Plant.** Ashley, C.; Zeigler, C.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1973. Contract AC09-76SR00001. 13p. NTIS, PC A02; 3; GPO Dep. Order Number DE84013169.

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This report summarizes releases of radioactive materials to the environs of the Savannah River Plant during the calendar year 1973. Total quantities of radioactivity released from plant startup through 1973 are also reported. Accuracy is not always implied to the degree indicated by the number of significant figures reported. Values were not rounded off, since data will be used in future cumulative summaries. 12 tables.

34303 **(DPSPU—84-30-1) Environmental monitoring in the vicinity of the Savannah River Plant. Annual report for 1983.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1983. Contract AC09-76SR00001. 233p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84013817.

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In 1983, the impact of SRP operations on public health was insignificant. The highest radiation dose to a hypothetical adult individual on the SRP boundary from 1983 atmospheric releases of radioactive materials was 1.3 millirem (mrem). Doses to some age groups were slightly higher than the adult dose (maximum 1.9 mrem to a child.) The average radiation dose that a hypothetical adult at the SRP boundary received from atmospheric releases was 0.54 mrem during 1983. For persons living within 50 miles of SRP, the average dose was 0.15 mrem per year. The maximum radiation dose to adults downriver of SRP who consumed water from the Port Wentworth water treatment plant near Savannah, GA, was 0.22 mrem in 1983. The maximum adult dose from consuming water from the Beaufort-Jasper, SC, water treatment plant was 0.16 mrem. These radiation doses from SRP operations are small compared to the dose from natural radiation, which averages 93 mrem per year near SRP. Additionally, doses from SRP operations are small compared to the geographical differences in natural radiation. The annual natural radiation dose to Georgia and South Carolina

residents within 100 miles of SRP varies from place to place by as much as 60 mrem. The concentrations of nonradioactive materials of SRP origin in offsite air and water continued to be well within federal and state limits. 58 figures, 110 tables.

34304 **(DPST—80-351(DEL)) Radiological effect of SRP operations, 1979.** Marter, W.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 16 May 1980. Contract AC09-76SR00001. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013171.

An analysis was made of the radiological effect of releases of radioactive materials to the environment from SRP operations in 1979. Release data were provided by the Health Protection Department. The more significant findings of this analysis were: atmospheric tritium releases in 1979 were 89% of those in 1978 (340,000 Ci vs 380,000 Ci). Reductions occurred primarily in Separations Areas and accounted for most of the reduction in offsite doses in 1979 (124 man-rem in 1979 vs 136 man-rem in 1978). Atmospheric releases of noble gases (excluding argon-41) from the reactors increased significantly (15,350 Ci in 1979 vs 6200 Ci in 1978) as a result of target failures. The 1979 offsite dose from these noble gases was 1.8 man-rem (vs 0.7 man-rem in 1978). Liquid tritium releases in 1979 were 73% of those in 1978 (29,000 Ci vs 40,000 Ci). Reductions occurred as a result of the first full year of operation of seepage basins in P and C Areas (basins were reactivated in mid-1978). Reduced tritium releases accounted for a reduction of about 4 man-rem to downstream consumers of river water. 11 tables.

34305 **(EGG—10282-1011) Aerial radiological survey of the Brookhaven National Laboratory and surrounding area, May 1980.** Hobaugh, J.L.; Steiner, P.A. (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC08-83NV10282. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013548.

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An aerial radiological survey was performed from 15 to 18 May 1980 over approximately a 21-square-kilometer (8-square-mile) area surrounding the Brookhaven National Laboratory (BNL). BNL is located in the center of Suffolk County, Long Island, New York. All gamma radiation data were collected by flying north-south lines spaced 91 meters (300 feet) apart at an altitude of 61 meters (200 feet) above ground level. A total of 17 anomalous areas were identified. The dominant isotopes found over these areas were cesium-137, manganese-54, and cobalt-60. All anomalies identified by the aerial measurements were correlated to site activities and storage facilities. 4 references, 18 figures, 1 table.

34306 **(EGG—10282-1034) Aerial radiological survey of the Waterford Generating Station and surrounding area, Taft, Louisiana. Date of survey: March-April 1982.** Jaffe, R.J.; Feimster, E.L. (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Feb 1984. Contract AC08-83NV10282. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013485.

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An aerial survey of the Waterford Generating Station near Taft, Louisiana was conducted during the period March 24 through April 7, 1982. The area encompassed a 256-square-kilometer (100-square-mile) area centered on the reactor facilities. Inferred exposure rates were due primarily to naturally occurring gamma-emitting radionuclides and cosmic ray activity (estimated at 3.7 μR/h). The exposure rates varied from 7 to 60 μR/h. Throughout most of the residential/industrial areas, the inferred exposure rate range was 7 to 12 μR/h. Marsh and water-covered areas were less than 7 μR/h. Two areas were encountered which had activity elevated above the typical background: (1) an industrial waste pond located 2 kilometers southeast of the site, and (2) a small area located 5 kilometers southeast of the site on the south bank of the Mississippi River. (A river barge was docked at this location during the survey.) Maximum inferred exposure rates over these areas were 60 and 16 μR/h, respectively. Spectral analysis revealed gamma-emitting radionuclides of the uranium decay chain as the primary contributors to this elevated activity. Ground-based measurements made in several areas were consistent with the aerial data. This was the first aerial radiological survey conducted over this area. 3 references, 9 figures, 3 tables.

34307 **(EGG—10282-1038) Aerial radiological survey of the Palo Verde Nuclear Generating Station and surrounding area, Wintersburg, Arizona. Date of survey: November 1982.** Semmler, R.A. (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Jan 1984. Contract AC08-83NV10282. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013489.

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An aerial survey of terrestrial gamma radiation was performed during the period 4 November through 15 November 1982 over a 16-kilometer by 16-kilometer (10-mile by 10-mile) area approximately centered on the Palo Verde Nuclear Generating Station near Wintersburg, Arizona. Gamma radiation spectral data were collected while flying a helicopter over a regular pattern of parallel lines spaced 150 meters (500 feet) apart at an altitude of 90 meters (300 feet). All radiation measurements taken at the nominal flight altitude were corrected for altitude variations, cosmic radiation, and helicopter background to generate exposure rates from terrestrial sources extrapolated to 1 meter above ground level. The data are presented as isoradiation contour maps. The average terrestrial radiation levels fall between 8 and 14 microrentgens per hour (μR/h). All gamma radiation detected within the survey area was associated with naturally occurring radionuclides. Direct ground-based measurements at 1 meter height were also taken at four scattered sites within the survey area. These values agree with the contour intervals determined from the aerial measurements and differ from the mean value of adjacent contours by no more than 10%. 6 references, 5 figures, 2 tables.

34308 **(GSF-S—956) Radionuclide concentrations in ground level air and precipitation in South Germany from 1976 to 1982.** Hoetzl, H.; Rosner, G.; Winkler, R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Aug 1983. 107p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751477.

The activity concentrations of fallout radionuclides from atmospheric nuclear test explosions and of Be-7 in ground level air and precipitation have been determined by the Institut fuer Strahlenschutz at Munich-Neuherberg since 1970. While methods and results from 1970 to 1975 have been published in a previous report, the present report describes the revised program which includes now the naturally occurring nuclides Pb-210 and Po-210, as well as H-3. Sampling methods, analytical techniques and measuring procedures are given. The results up to the end of 1982 are reported and seasonal and long-term variations of radionuclide concentrations as well as frequency distributions of the data are discussed. The data are compared with those of other stations. As a consequence of some recent atmospheric nuclear test explosions by the People's Republic of China also short-lived radionuclides have been detected in ground level air and precipitation. The radiation exposure due to the radioactivity in ground level air and precipitation is estimated.

34309 **(INIS-mf—8335) Investigations on natural radioactivity of indoor air pollution. Fundamental findings serving to estimate X-irradiation by inhalation of radon- and thoron daughter products.** Wicke, A. (Giessen Univ. (Germany, F.R.). Fachbereich Physik). 13 Dec 1979. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780302.

The behaviour of radon 222 and its daughter products in indoor air and the corresponding processes are explained and quantitatively recorded (as far as possible). Main subject of all considerations are those processes, which induce the development of radon-222 activity in indoor air, the formation of free and aerosol-bound daughter products and their partial loss due to air-exchange and deposition processes. Finally the contribution of natural indoor radioactivity to the natural exposure to radioactivity of man (rate of ventilation) is estimated on the basis of the presently available measuring data. This estimation bases on an investigation of those mechanisms, which are responsible for a continuous supply of radon and thoron by the building wall-material. (orig./HP).

34310 **(KFK—3566) Comparison of the atmospheric dispersion models UFOMOD and MESOS.** Vogt, S.; Neumann-Hauf, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Nov 1983. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751438.

UFOMOD and MESOS are compared concerning the calculated airborne concentrations of noble gases, quantities of radionuclides deposited, or the fractions of radionuclides remaining in the atmosphere, respectively, as well as calculated ground-level contamination due to Cs-137 and I-131 at well-defined locations at different distances and directions from the point of release (MESOS) and at well-defined locations at different distances averaged over all directions of transportation (UFOMOD) (height of release 10 m). On the average, the mean airborne concentration and ground-level contamination differ by a factor less than five. If one compares - integrated overall deposited by dry deposition only without considering wet deposition during transport and vice versa integrated over all dispersion directions (MESOS and UFOMOD) considerable differences emerge between the models, especially concerning the calculation of wet deposition. Here, differences amount to a factor of two. However, if, in addition the probability of a location being exposed is also taken into account, the model differs by factors up to 10 at selected locations. It is shown how UFOMOD calculations can be improved and adapted to reality by additional information from MESOS calculations.

34311 **(KY—742) Environmental monitoring report: United States Department of Energy, Paducah Gaseous Diffusion Plant, calendar year 1983.** (Paducah Gaseous Diffusion Plant, KY (USA)). May 1984. Contract AC05-84OU21400. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012711.

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Air, water, soil, sediments, grass, and groundwater in the vicinity of the Paducah Gaseous Diffusion Plant were continuously or periodically sampled during 1983. Analyses for materials known to be in plant effluents were made to provide effluent control information and to determine compliance with applicable environmental standards. Low sulfur coal is burned in the steam plant to meet Kentucky emission limits for sulfur dioxide. Air analyses for radioactivity indicated concentrations at each offsite sampling station averaged less than 1% of the applicable Radioactivity Concentration Guide. Offsite analyses for fluorides in grass met the Kentucky Air Quality Requirements. All onsite and offsite airborne fluoride samples met the Kentucky one-week and one-month standards for gaseous HF. Soil samples were analyzed for uranium and showed no significant deviation from normal background concentrations. There was no detectable change in chemical, physical, or radioactive characteristics of either the Ohio River or ground water attributable to Paducah Gaseous Diffusion Plant operations. The results of water sample analyses of the Ohio River show the chromium and fluoride concentrations to be in compliance with the requirements of the applicable Kentucky regulations. Algal activity resulted in an increase in pH violations during 1983. 7 references, 7 figures, 26 tables.

34312 **(LA—10100-ENV) Environmental surveillance at Los Alamos during 1983.** (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 189p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013933.

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This report documents the environmental surveillance program conducted by the Los Alamos National Laboratory during 1983. Routine monitoring for radiation and radioactive or chemical substances is conducted on the Laboratory site and in the surrounding region to determine compliance with appropriate standards and permit early identification of possible undesirable trends. Results and interpretation of data for 1983 are included on external penetrating radiation; on the chemical and radiochemical quality of ambient air, surface and ground waters, municipal water supply, soils and sediments, and foodstuffs; and on the quantities of airborne emissions and liquid effluents. Comparisons with appropriate standards, regulations, and background levels from natural or other non-Laboratory sources provide a basis for concluding that environmental effects attributable to Laboratory operations are insignificant and are not considered hazardous to the population of the area of Laboratory employees. 61 references, 34 figures, 22 tables.

34313 **(LBL—17622) Annual environmental monitoring report of the Lawrence Berkeley Laboratory, 1983.** Schleimer, G.E. (ed.). (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013881.

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The Environmental Monitoring Program of the Lawrence Berkeley Laboratory is described. Data for 1983 are presented and general trends are discussed. 7 references, 7 figures, 11 tables.

34314 **(PB—84-156421) Airborne emission control technology for the elemental phosphorus industry. Final report.** Stula, R.T.; Belanger, R.E.; Clary, C.L.; May, R.F.; Spaeth, M.E. (Science Applications, Inc., La Jolla, CA (USA)). Jan 1984. 412p. NTIS, PC A18/MF A01.

Preliminary estimates by the U.S. Environmental Protection Agency (EPA) have indicated the potential for significant radiation doses to individuals near elemental phosphorus plants. During plant operations radionuclides associated with particulates and volatile metallic element radionuclides are released to the atmosphere. Of special interest are polonium-210 and lead-210. The purpose of this work assignment is to apprise EPA of the status of emission of radionuclides to the atmosphere. This work assignment involves collection of information on emission control technology related to the development of standards under the Clean Air Act. Each work task is designed as a chapter to be incorporated into a Background Information Document for the elemental phosphorus industry. Topics covered include general description of the industry and identification of plant-specific processes and emissions; plant-specific emission control techniques and costs; anticipated industry changes due to modernization, expansion, or process alterations; and definition of a model elemental phosphorus plant representative of those currently in operation. Three levels of control, ranging from minimum to maximum application of emission control techniques, are defined for the model plant along with estimated emissions and equipment costs.

34315 **(PB—84-166818) Analytical capability of the environmental radiation ambient monitoring system.** Broadway, J.A.; Mardis, M. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Sep 1983. 74p. (EPA—520/5-83-024). NTIS, PC A04/MF A01.

The ERAMS program is composed of a network of sampling stations throughout the United States plus an associated radioanalytical and assessment support group. These components provide a capability to evaluate environmental consequences from both normal ambient concentrations of radiation and time dependent changes as measured by the samples. The program is structured to measure concentrations of radionuclides in air, milk, surface water, and drinking water and to estimate dose and health impact. Several examples of short-term and long-term assessments of dose and health effect calculations from the ERAMS data base have been presented in this report.

34316 **(PB—84-175108) Environmental Radiation Data, report 35 (July-September 1983).** (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Dec 1983. 47p. (EPA—520/1-84-004). NTIS, PC A03/MF A01.

See also PB84-149145.

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs Eastern Environmental Radiation Facility (EERF), Montgomery, Alabama. Data from the Environmental Radiation Ambient Monitoring

System (ERAMS), and similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reported in (ERD) when available. The ERAMS is comprised of nationwide sampling stations that provide air, surface, and drinking water and milk samples from which environmental radiation levels are derived. The major emphasis for ERAMS is toward identifying trends in the accumulation of long-lived radionuclides in the environment.

34317 **(PNL—3777-Rev.1) Hanford Dose Overview Program: standardized methods and data for Hanford environmental dose calculations. Rev. 1.** McCormack, W.D.; Ramsdell, J.V.; Napier, B.A. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013510.

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This document serves as a guide to Hanford contractors for obtaining or performing Hanford-related environmental dose calculations. Because environmental dose estimation techniques are state-of-the-art and are continually evolving, the data and standard methods presented herein will require periodic revision. This document is scheduled to be updated annually, but actual changes to the program will be made more frequently if required. For this reason, PNL's Occupational and Environmental Protection Department should be contacted before any Hanford-related environmental dose calculation is performed. This revision of the Hanford Dose Overview Program Report primarily reflects changes made to the data and models used in calculating atmospheric dispersion of airborne effluents at Hanford. The modified data and models are described in detail. In addition, discussions of dose calculation methods and the review of calculation results have been expanded to provide more explicit guidance to the Hanford contractors. 19 references, 30 tables.

34318 **(Y/UB—19) Environmental monitoring report, United States Department of Energy, Oak Ridge Facilities, calendar year 1983.** (Oak Ridge Y-12 Plant, TN (USA)). 15 Jun 1984. Contract AC05-84OS21400. 126p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013888.

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The Environmental Monitoring Program for the Oak Ridge area includes sampling and analysis of air, water from surface streams, creek sediments, biota, and soil for both radioactive and nonradioactive materials. This report presents a summary of the results of the program for calendar year 1983. Surveillance of radioactivity in the Oak Ridge environs indicates that atmospheric concentrations of radioactivity were not significantly different from other areas in East Tennessee. The levels of radioactivity were between 0.02 and 0.03 percent of the DOE concentration guides (CG) which has been the case since 1980. Levels of radioactivity in rainwater samples collected in the Oak Ridge area were not significantly different from those collected at remote locations. Concentrations of radioactivity in the Clinch River and in fish collected from the river were less than two percent of the permissible concentration and intake guides for individuals in the offsite environment. While some radioactivity was released to the environment from plant operations, the concentrations in all of the media sampled were well below established DOE standards, as has been the case since the inception of these reports. Surveillance of nonradioactive materials in the Oak Ridge environs shows that established limits were not exceeded for those materials present in the air as a result of plant operations except for suspended particulates in the Y-12 Plant area. The chemical water quality data in surface streams obtained from the water sampling program indicated that average concentrations resulting from plant effluents were in compliance with State Water Quality Criteria for fish and aquatic life with the exception of cadmium, copper, fluoride, lead, mercury, and zinc. 35 references, 22 figures, 55 tables.

34319 **Comments on natural tritiated moisture levels in air vary with atmospheric pressure.** Oestlund, H.G. (Miami Univ., FL (USA). Rosenstiel School of Marine and Atmospheric Sciences); Mason, A.S. (Los Alamos National Lab., NM (USA)). *International Journal of Applied Radiation and Isotopes;* **35**: No. 2, 143(Feb 1984).

Letter to the editor.

34320 **Electrical aspects of rainout.** Rosenkilde, C.E.; Serduke, F.J.D. (Lawrence Livermore National Lab., CA). pp 573-582 of Precipitation scavenging, dry deposition, and resuspension. Volume 1. Precipitation scavenging. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1983). (CONF-821136—Vol.1). TI84002447

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Under extreme conditions, the radioactivity of fresh nuclear debris particles greatly alters the electrical phenomena within a natural cloud. There is sufficient beta and gamma activity to generate ions in the atmosphere at rates many orders of magnitude higher than those associated with natural terrestrial sources and cosmic rays. This ion production, when counterbalanced by recombination and attachment, yields steady-state ion concentrations that are several orders of magnitude greater than those present in fair weather. Such concentrations of ions greatly reduce the chance of accumulating large droplet charges or of generating high electric fields. Consequently, electrical interactions which lead to scavenging are estimated to be considerably less potent in the presence of fresh nuclear debris than might have been expected on the basis of parameters associated with natural thunderstorms. Rosenkilde has given a more detailed description of the work being summarized here. 8 references, 5 figures.

34321 **Dry deposition model sensitivity.** Lewellen, W.S.; Varma, A.K.; Sheng, Y.P. (Aeronautical Research Associates of Princeton, Inc., NJ). pp 859-870 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The present understanding of the basic dependence of deposition velocity on a number of independent variables is reviewed. The dependence on atmospheric stability, through its effect on turbulent transport within the surface layer, is the most amenable to direct analysis. The aggregate effect of turbulent transport within individual canopy structures and the viscous sublayer on the basic elements of the surface canopy is considerably more difficult to analyze. The actual surface chemical reactivity can generally only be determined by experiment. If the effluent of interest is in the form of small particles, the viscous sublayer on the canopy surface is likely to be the dominant factor in determining the deposition. Deposition velocity for some of the effluents which may be expected from a nuclear reactor accident are estimated. This requires first estimating the uncertainties in the local meteorological variables, the surface canopy variables, and the physical/chemical properties of the main effluents of interest. These uncertainties in the independent variables are translated into uncertainties in deposition velocity. 6 references, 3 figures, 1 table.

34322 **Some recent studies of the resuspension of deposited material from soil and grass.** Garland, J.A. (AERE, Harwell, England). pp 1087-1097 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Wind tunnel experiments showed that resuspension increases rapidly with wind speed, but does not show a threshold corre-

sponding to that for saltation. The resuspension rate declined as the inverse of time of exposure to the wind, and not exponentially. All tracers tested showed these features, and submicron powder showed similar resuspension behavior on soil and on grass. Large particles suspended more rapidly than small. Resuspension factors of 20 year old deposits were estimated using atmosperic concentrations of fallout and trace elements. Upper limits of order 10^{-11} or 10^{-10} m^{-1} were obtained. Extrapolation from small scale experiments to large scale contamination incidents requires only a modest increase in resuspension factor, K. Deposition of suspended material over a scale of metres can be significant, leading to an effect of experimental scale on estimates of the resuspension rate, Λ. 12 references, 3 figures.

34323 **Quantitative comparison of five suspension models.** Smith, W.J. II; Whicker, F.W. (Colorado State Univ., Fort Collins). pp 1099-1109 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A specific example is used to demonstrate an approach to the selection and comparison of models of particle entrainment. The problem is to estimate airborne mass flux from a hard-rock thorium ore stockpile. As a source of airborne particles an ore stockpile differs greatly from the sources used to develop an understanding of particle entrainment. The hypothetical ore pile would be a mounded, angular pile consisting primarily of relatively large rocks, but including in its wide range of particle sizes the very small fines from blasting and mining. Models must be selected that are capable of reflecting the unique features of a stockpile. The major thorium ore deposit is found along the continental divide near Lemhi Pass in the Beaverhead Mountains of southwestern Montana. The hypothetical ore pile of this example would be located at the base of the mountains, at fairly high elevation (2200 m). This location is characterized by harsh winters with heavy mountain snowfall, and summers with frequent thunderstorms and high evaporative potential. 15 references, 6 figures, 5 tables.

34324 **Scavenging ratios and dry deposition velocities of radioactive particles in the tropical regions of India.** Rangarajan, C.; Eapen, C.D. (Bhabha Atomic Research Centre, Bombay, India). pp 1271-1279 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Dry deposition velocities and scavenging ratios are presented for a number of stations in India. The variation in scavenging ratios at a place was more than the differences in the average values at various locations studied. It was concluded that, a crude global-average value may be adequate for first-order calculations, but more accurate estimates may require the inclusion of precipitation type, height, amount, and vertical activity distributions into scavenging models. 8 references, 4 figures, 1 table.

34325 **Atmosphere to snow transfers in Antarctica.** Lambert, G.; Ardouin, B.; Mesbah-Bendezu. (Centre des Faibles Radioactivites, Gif-sur-Yvette, France; Universite de Picardie, Saint-Quentin, France). pp 1289-1300 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The objective of this study is to determine the washout factor of radioactive aerosols by Antarctic snow, on a basis of one or several years. Owing to the necessity to compare the activities of air and snow at the same date, gross β or γ measurements cannot be used as there is no possible correction of radioactive decay. Therefore two nuclides, artificial ^{90}Sr and natural ^{210}Pb, are used. As far as possible wet and dry fallout are distinguished. 18 references, 6 tables.

34326 **^{210}Pb as a tracer of the deposition of sub-micrometer aerosols.** Graustein, W.C.; Turekian, K.K. (Yale Univ., New Haven, CT). pp 1315-1324 of Precipitation scavenging, dry deposition, and resuspension. Volume 3. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

^{210}Pb deposition rates can be obtained in soils in which the organic matter is concentrated in a surface layer. If the organic matter is uniformly distributed through the soil, the correction for ^{210}Pb produced becomes larger and the precision of the deposition rate estimate decreases. Forest soils are generally well suited for ^{210}Pb deposition rate measurements. The rate of ^{210}Pb deposition to New England lowlands averages 1.0 dpm cm^{-2} yr^{-1}. There is no evidence for systematic spatial variability in the deposition rate. Deposition rates are uniform. The amount of dry deposition of ^{210}Pb is too small to be measured by the methods used. Even in an area where impaction on foliage is a major removal mechanism for giant aerosols, vegetation has no apparent effect on the ^{210}Pb deposition rate. The ^{210}Pb deposition rate in a mountainous region is determined by the rate of water deposition by precipitation and in-cloud droplet impaction. The deposition rate of other species originating from the continental surface and residing in sub-micrometer aerosols, such as sulfate, should be estimatable at any given site using the species/^{210}Pb deposition ratio in aerosol particles and the ^{210}Pb deposition rate at that site. 24 references, 1 figure, 1 table.

34327 **Size distribution of atmospheric Pb and ^{210}Pb in rural New Jersey: implications for wet and dry deposition.** Knuth, R.H.; Knutson, E.O.; Feely, H.W.; Volchok, H.L. (Dept. of Energy, New York, NY). pp 1325-1335 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

High volume cascade impactor samples taken during spring, 1980, at the Chester sampling station in northern New Jersey showed a small but persistent difference in the size distributions of Pb and ^{210}Pb. On the average, 69% of Pb was below 0.58 μm and 12% was above 3.45 μm. For ^{210}Pb, the corresponding figures were 71% and 2.8%. These ^{210}Pb data indicate larger particles than found in Colorado, but smaller than those found over the Mediterranean Sea. The average air concentrations for the two species were 111 ng/m^3 (Pb) and 10.9 fCi/m^3 (^{210}Pb), in good agreement with other reported results for rural northeast areas. Experimental results imply a factor of three difference in dry deposition velocity between the two species, providing a qualitative explanation of a previously observed difference in wet/dry deposition of the two species. 19 references, 1 figure, 6 tables.

34328 **Mean residence time of the submicrometer aerosols in the global troposphere.** Lambert,; Sanak, J.; Polian, G. (Centre des Faibles Radioactivities, Gif-sur-Yvette, France; Universite de Picardie, Saint-Quentin, France). pp 1353-1359 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A 2 box model for ^{222}Rn and its decay products is presented. It is assumed that the reservoir considered is the atmosphere and that the integration time is very long relative to the residence

time. This results in a single reservoir in steady state and the mean can be defined with respect to the total amount of atmospheric aerosols. Because of the difference between aerosol residence times in the tropospheric and the stratosphere, these reservoirs were considered separately. 27 references, 1 figure, 1 table.

34329 **Environmental radiation monitoring system development for atmospheric plumes from light water reactor nuclear power plants.** Ohba, T.; Ishida, K.; Kitada, Y.; Kobayashi, A.; Takimoto, S.; Tsunoda, T. (The Tokyo Electric Power Company Operation and Maintenance Department Fukushima Daiichi Nuclear Power Station Ohkuma-cho, Futabagun, Fukushima). *Nuclear Technology;* **56**: No. 3, 580-593(Mar 1982).

The environmental monitoring system for radiation exposure due to light water reactor (LWR) nuclear power plant plume is described. This system, employing a NaI(Tl) scintillation detector with an exposure rate conversion circuit, has the capability of highly accurate evaluation of radiation exposure due to an LWR plume with 0.15 million R/yr (39 nC/kg.yr) overevaluation and 0.05 million R/yr (13 nC/kg.yr) underevaluation. Plume exposure is identified by combining the time variation property of the exposure rate with meteorological parameters. Outlines of the present system are described, including monitoring results obtained over a 98-day period by tentative system at an LWR site boundary.

5004 Thermal Effluents Monitoring And Transport

34330 **(EIR—500) Possibilities of anthropogenic modifications of thunderstorm activity.** Gassmann, F.; Haschke, D.; Rudin, F. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Nov 1983. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751281.

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Different approaches were used to estimate the number of thunderstorms that could be modified by anthropogenic heat rejection. As a result it was found that about 50% of the thunderstorms occurring annually over the Swiss plateau or the area around the city Basel offer the potential of an anthropogenic modification. On the basis of simplified physical models, the energy-flux to start a medium thunderstorm is estimated to about 0.01-0.1 GW, if the energy is available as kinetic energy, and about 100 GW for thermal energy. Computer simulations with a parcel model confirm these orders of magnitude. The model calculations indicate also, that the power required to start a small thunderstorm under especially critical (unstable) weather situations can be an order of magnitude smaller than the above values. Comparing the required 100 GW thermal starting energy-flux with a single dry or wet 2 GW cooling tower suggests, that for climatic conditions typical for Switzerland, the formation of a thunderstorm due to cooling tower heat rejection is a very unlikely event. Power parks consisting of 30-50 dry cooling towers rejecting 2 GW each would be required to severely modify thunderstorm activity in their surroundings. About 5 to 10 coolind towers concentrated at one site would probably be a critical limit. When exceeded, modification of thunderstorm activity seem to become climatologically significant.

5006 Regulations

REFER ALSO TO CITATION(S) 32662, 34374, 34479

34331 **(DOE/SR/00001—T25) Release guides for liquid radioactive releases to streams and basins.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1984. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013358.

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Limits for the release of radionuclides to the atmosphere or to watersheds are given for various areas of the Savannah River Plant. (ACR)

34332 (EPRI-CS—3182-Vol.1, pp 1.1-1.12) **Update on NO/sub x/ related regulations.** Walters, D.F. (Environmental Protection Agency, Research Triangle Park, NC). Jul 1983. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304. Order Number TI84920101. (CONF-8211146—Vol.1).

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

The status of significant NO_2/NO/sub x/ regulatory actions were updated. The current review of the national ambient air quality standard for NO_2 which is presently an annual standard at 100 micrograms per cubic meter (.053 ppM) (the ongoing review has looked at the possibility of a short-term NO_2 standard); a review of new source performance standards for stationary sources; mobile source regulations for NO_2; prevention of significant deterioration regulations and new source review requirements; and implementing new monitoring requiements for NO_2. 4 tables.

34333 **(PB—84-156777) Air quality criteria for particulate matter and sulfur oxides.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Criteria and Assessment Office). Dec 1982. 1519-in 3vp. NTIS, PC E99.

Set includes PB84-156785 through PB84-15680.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 34179, 34326

34334 **(PNL-SA—12129) Shoot production and mineral nutrient assimilation in cheatgrass communities on the Arid Lands Ecology Site.** Rickard, W.H. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-76RL01830. 23p. (CONF-8406144—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013404.

From Research in arid and semiarid lands meeting; Washington, DC, USA (4 Jun 1984).

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The purpose was to determine annual shoot production in two 30-year old cheatgrass communities that had not been grazed by domestic livestock and to compare their concentrations of tissue assimilated mineral nutrients. The data indicate that the community at the low elevation produced more shoot biomass with less precipitation than the high elevation community. Nitrogen appeared to be less available to shoots at the high elevation. 20 references, 4 figures, 5 tables.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 32565, 33938, 34234, 34236, 34266, 34269, 34270, 34271, 34272, 34273, 34279, 34322, 34432, 34433, 34490

34335 **(CONF-8305200—2) Lead in vegetation, forest floor material, and soils of the spruce-fir zone, Great Smoky Mountains National Park.** Bogle, M.A.; Turner, R.R. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012353.

From Symposium on the Southern Appalachian spruce-fir ecosystem: status, threats, and management; Gatlinburg, TN, USA (1 May 1983).

Based on a survey during 1982, lead concentrations in vegetation, litter and soils of the spruce-fir zone of the Great Smoky Mountains National Park are generally less than values reported for similar sites in the northeastern United States and western Europe. As expected, lead concentrations increased with increasing age of spruce and fir foliage, and with increasing degree of decomposition of litter. Fir bole wood was higher in lead than spruce bole wood, but both species were far below acutely phytotoxic levels. Although the results of this study indicated no immediate cause for

concern, periodic monitoring of lead and other metals in the spruce-fir zone should be continued to provide early detection of significant changes. 32 references, 1 figure, 4 tables.

34336 **(DOE/EV/10750—T1) Effects of acid precipitation on forest soils and watershed biogeochemistry in New England. A technical progress report.** Cronan, C.S. (Maine Univ., Orono (USA). Dept. of Botany and Plant Pathology). May 1984. Contract AC02-81EV10750. 75p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84012966.

The research described was initiated to address the need for improved understanding of the mechanistic linkages between forest growth and acidic depositing. A long-term whole-system investigation of forest responses to acidic deposition has been initiated. Nutrient depletion and availability in forest soils, plant nutrient status, trace metal cycling and toxicity, plant disease resistance, and overall plant productivity is emphasized. 48 references, 4 figures, 7 tables.

34337 **(Juel-Spez—224) Methods to evaluate ecotoxicological effects of chemicals. Vol. 2.** Fuehr, F.; Biehl, H.M.; Thielert, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Oct 1983. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751283.

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The Minister of Science and Technology supports research in the field of "methods to evaluate ecotoxicological effects of chemicals". In the ecosystem the soil is the major sink for environmental chemicals. In a coordinated programme several laboratories have conducted research to evaluate and standardize different methods to study degradation, accumulation and effects of chemicals in the soil. Results from a four year study are presented in five reports on adsorption/desorption, translocation and degradation of chemicals of 15 soils of the Federal Republic of Germany. Partially laboratory results are compared with data achieved in field studies. The following test chemicals have been included in the programme: Cd-, Hg-, Cr-, and Se-compounds, the herbicides 2,4,5-T, and pichloram, the tenside LAS, PCB as well as halogenorganic compounds. On the basis of the results standardized test methods are proposed.

34338 **(PB—84-148840) Development of chemical countermeasures for hazardous waste contaminated soil.** Ellis, W.D.; Payne, J.R.; Tafuri, A.N.; Freestone, F.J. (JRB Associates, Inc., McLean, VA (USA)). Jan 1984. 31p. NTIS, PC A03/MF A01.

The objective of this project is to evaluate the efficacy of in-situ treatment of large volumes of subsurface soils, and large, relatively quiescent waterbodies. To date, efforts have concentrated on soils-related activities to determine whether significant enhancements to the in-situ cleanup of chemically contaminated soils with standard water washing techniques could be obtained by using aqueous surfactants. The addition of the surfactant mixtures was designed to improve the solvent properties of the water and enhance the removal of adsorbed chemical contaminants.

34339 **Dry deposition of nitrogen dioxide to Scots pine needles.** Grennfelt, P.; Bengtson, C.; Skaerby, L. (Swedish Water and Air Pollution Research Inst., Goeteborg, Sweden; AB Haessle, Moelndal, Sweden). pp 753-762 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Vegetation is important as a sink for atmospheric pollutants, e.g., sulphur dioxide and particles. Although data are sparse, there are indications that the same is true also for nitrogen dioxide. In addition, the possible effects of deposited compounds must be considered. The input of nitrogen compounds might together with sulphur oxides, be of importance for the acidification of soils and groundwater of forest ecosystems. The dry deposition of NO_2 probably gives an essential contribution to the total nitrogen input. In order to obtain basic data for deposition estimates of NO_2 to forest ecosystems the uptake of NO_2 in Scots pine needles was studied in the field. A gas exchange system was used, originally designed for measurements of photosynthesis and transpiration. The objective was to study the uptake of NO_2 during natural climatic conditions and to see how the uptake varied with changes in these conditions. In addition possible physiological effects (on photosynthesis and transpiration) due to the NO_2 exposure were studied. 8 references, 4 figures, 2 tables.

34340 **Dry deposition of SO_2 onto a Scots pine forest.** Fowler, D.; Cape, J.N. (Inst. of Terrestrial Ecology, Midlothian, Scotland). pp 763-773 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The results reported are field measurements of rates of dry deposition of SO_2 onto Scots pine (Pinus sylvestris L) in a range of atmospheric and surface conditions. Rates range from 0.5 to 10 mm s^{-1}. During the day stomata are the major sink, absorbing ~ 80% of the total flux for a deposition rate of 5 mm s^{-1}. As stomata close the uptake by other surfaces (cuticles, bark and forest floor) begin to dominate but collectively the rates of deposition onto these surfaces, on dry nights are no more than 1 mm s^{-1}. A mesophyll resistance to SO_2 uptake within stomata has been observed, which may contribute 50% of the total resistance to transfer, but further field measurements are required to determine the properties of this resistance. For a rain wetted canopy rates of deposition are 2 to 3 mm s^{-1} and show the presence of a significant canopy resistance (300 s m^{-1}). Uptake by wetted surfaces appears to be controlled by the chemistry of the liquid film on vegetation. 18 references, 3 figures, 3 tables.

34341 **Dry deposition on coniferous forest of SO_2 at ppb levels.** Johansson, C.; Richter, A.; Granat, L. (Univ. of Stockholm, Sweden). pp 775-784 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Results obtained with mobile equipment designed to measure surface resistance during deposition of trace gases to a forest canopy are presented. Measurements were made with concentrations down to low ppB levels of SO_2, NO/sub x/ and NO and a few tens of ppB of O_3. Results are as follows: deposition of SO_2 is higher than can be predicted by stomatal conductance - during daytime twice as high, sometimes even higher; the hypothesis of a linear relation between deposition and trace gas concentration (other factors being constant); Previous findings of a very pronounced diurnal variation are confirmed. The variation does not, however, follow a simple cycle and the deposition velocity can vary with a factor of 2 from one day to the following depending on climatic fluctuations; part of a seasonal variation has been revealed in that almost no deposition to the canopy was found in winter. Some variation also occurs during the growing season; and SO_2 concentration ranges found in rural Sweden a deposition velocity of 0.5 cm s^{-1} during summer and 0.1 cm s^{-1} in winter were estimated. 10 references, 3 figures.

34342 **Measurements of the dry-deposition flux of nitric acid vapor to grasslands and forest.** Huebert, B.J. (Colorado Coll., Colorado Springs). pp 785-794 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The dry flux of HNO_3 vapor to a variety of terrains was measured using a modified Bowen-ratio method. Nitric acid concentration and temperature were measured at each of two or three heights above the ground, and sensible-heat fluxes were measured by an eddy-correlation technique. 15 references, 3 tables.

34343 **Experimental constraints in micrometeorological gaseous pollutant fluxes.** Droppo, J.G.; Doran, J.C. (Battelle Pacific Northwest Labs., Richland, Washington). pp 807-815 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

This paper presents the results of simultaneous ozone eddy flux and profile measurements performed during the summer 1982 Environmental Protection Agency (EPA) Dry Deposition Intercomparison Experiment at a site near Champaign, Illinois. These data provide an opportunity to investigate sources of variability in pollutant flux rates. Ozone eddy flux and profile values are combined to compute both ozone eddy diffusivities and deposition velocities. A comparison is made with momentum and heat turbulence analogies in relation to the independently measured and computed eddy flux values. The profile method is shown to give results which correspond well to those obtained from eddy correlation measurements. 4 references, 3 figures, 2 tables.

34344 **Threshold velocities for wind erosion on natural terrestrial arid surfaces (a summary).** Gillette, D.A. (Air Resources Labs./NOAA, Boulder, CO). pp 1047-1057 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

This review summarizes measurements of threshold friction velocity soils and relates those measurements, when possible, to laboratory and theoretical studies. Soils having loose particles on the surface and crusted soils are discussed. Finally, a few special mechanisms creating low threshold velocities are noted. 22 references, 5 figures.

34345 **Concept of resuspension rates applied to problems of fugitive dust emissions and wind erosion.** Gillette, D.A.; Cowherd, C. (Air Resources Labs./NOAA, Boulder, CO; Midwest Research Inst., Kansas City, MO). pp 1059-1072 of Precipitation scavenging, dry deposition, and resuspension. Volume 2. Proceedings. Pruppacher, H.R.; Semonin, R.G.; Slinn, W.G.N. New York, NY; Elsevier Science Publishing Co., Inc. (1983). (CONF-821136—Vol.2). TI84002448

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Specialized terminology has been developed to express the results of the investigations on particle resuspension. This paper reconciles some of the terminology by use of the resuspension concept. This is accomplished by developing a simple model of particle emission and then applying that model to the problem areas of fugitive dust emission and soil erosion. 8 references, 3 figures, 3 tables.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 32758, 32759, 34300, 34301, 34302, 34303, 34305, 34306, 34307, 34311, 34312, 34315, 34316, 34317, 34318, 34321, 34325, 34326, 34360

34346 **(DNA—8114-Rev.1) Radiological survey of Johnston Atoll. Dates of survey: April-August 1980. Revision 1.** Jaffe, R.J.; Tipton, W.J. (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Apr 1982. Contract AC08-83NV10282. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84012467.

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A radiological survey was conducted over all land areas of Johnston Atoll between April and August 1980. The survey was performed to locate and quantify residual surface transuranic (i.e., plutonium and americium) contamination resulting from three THOR missile aborts which occurred during that portion of the 1962 atmospheric nuclear testing series conducted by the United States from Johnston Island. A high purity germanium planar detector was utilized to enhance the detection sensitivity for the 59.5 keV gamma ray from ^{241}Am. Results are reported as equivalent surface concentration in units of nCi/m^2. Conversion factors are also included for several other assumed source distributions. Soil samples were obtained to determine plutonium-to-americium ratios. 7 references, 14 figures, 1 table.

34347 **The migration of ^{137}Cs and ^{90}Sr in multilayered soils: Results from batch, column, and fallout investigations.** Bachhuber, H.; Bunzl, K.; Gans, I.; Schimmack, W. (Gesellschaft fur Strahlen- und Umweltforschung mbH Munchen Institut fur Strahlenschutz, 8042 Neuherberg). *Nuclear Technology;* **59**: No. 2, 291-301(Nov 1982).

Rates of migration, retardation factors, and distribution coefficients of ^{137}Cs and ^{90}Sr were determined in the various horizons of three typical soils (podsol, ranker, and brown soil) by employing batch procedures, column experiments, and evaluating the measured distribution of these radionuclides in the field as a result of their deposition from worldwide fallout. To obtain the distribution coefficients of the radionuclides for each soil horizon from the column experiments, the radionuclide distribution in the undisturbed soil monoliths (1 m long, 30-cm diam) was determined from the outside by a scanner technique after various times. The columns were irrigated with rainwater using the same quantities as observed at the site of sampling. Tritium labeled rainwater was used to obtain the hydrodynamic properties of the soil columns (pore water velocity, dispersion coefficient, and volumetric moisture content). Assuming that the fallout investigations yielded the most realistic results, the observations suggest that column experiments performed in the laboratory under approximately natural conditions can be used to obtain fairly realistic information about the migration of ^{137}Cs and ^{90}Sr in these soils. The use of distribution coefficients from batch methods for the prediction of radionuclide movement, on the other hand, can be misleading, especially in soil horizons rich in organic matter.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 32563, 32815, 32816, 32826, 34338, 34516

34348 **(AD-A—137196/2) Installation restoration program. Phase I. Records search. Niagara Falls Air Force Reserve facility, New York.** (Engineering-Science, Inc., Atlanta, GA (USA)). Dec 1983. 184p. NTIS, PC A09/MF A01.

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation and Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Measures. Niagara Falls AFRF is located in Niagara County, New York, approximately six miles northeast of the City of Niagara Falls and approximately fifteen miles north of Buffalo. The installation is currently comprised of 985 acres with a base population of approximately 2,560. The following areas were determined to have a sufficient potential to create environmental contamination and follow-on investigation is warranted: Bldg. 600 JP-4 Pipeline Leak; POL JP-4 Tank C; Landfill; BX MOGAS Tank Leak; NYANG Hazardous Waste Drum Storage; POL JP-4 Tank A; JP-4 Tank Truck Spill; Bldg. 202 Drum Storage Yard; Fire Training Facility No. 1, 2 and 3; Bldg. 850 Drum Storage Yard; and AFRES Hazardous Waste Drum Storage.

34349 **(AD-A—137373/7) Installation Restoration Program Phase I - Records Search, O'Hare Air Reserve Forces Facility, Illinois.** (Engineering-Science, Inc., Atlanta, GA (USA)). Dec 1983. 301p. NTIS, PC A14/MF A01.

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases of consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation and Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. The O'Hare Air Reserve Forces Facility complex at O'Hare International Airport is located in the Chicago metropolitan area in northeastern Illinois. The airport is located northwest of downtown Chicago at the boundary of Cook County and DuPage County. All of the property around the airport and Air Force installation is urbanized and used for residential, commercial and/or industrial purposes. Nine areas were determined to have a sufficient potential for environmental contamination to warrant further investigation. They are as follows: Landfill No.1; JP-4 Tank, West POL Area; Fuel-Contaminated Soil; Defueling Pit Leak Site; Fire Protection Training Facility; Hazardous Waste Storage Area; Landfill No.2; Storm Drainage System; South Edge of Concrete Apron; Vehicle Maintenance Facility, Rear; and Low Level Radioactive Disposal Site.

34350 **(PB—84-151497) Technical assistance program report: consideration of the Resource Recovery option in Colorado. Final report.** (Hart (Fred C.) Associates, Inc., Denver, CO (USA)). May 1982. 157p. NTIS, PC A08/MF A01.

This report surveys the current Solid Waste Management in the State of Colorado. A comparison of landfill disposal with Resource Recovery in terms of costs and other factors are made. Roles and implications of State and local governments in the field of Resource Recovery are defined.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 34179, 34434, 34508

34351 **(DOE/BP—201) White sturgeon research needs: workshop results.** Fickeisen, D.H.; Neitzel, D.A.; Dauble, D.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 51p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013593.

This report describes the results of a workshop to develop a research program for Columbia River Basin white surgeon. Invited participants developed a list of white sturgeon research needs and rationale for ranking the relative ir portance of the research needs. The highest ranked research needs were: define physical habitat requirements (substrate, flow, water quality) for early life history stages; identify genetic stocks; assess population status (e.g., distribution, densities, age-structure, year-class strength, age-specific mortality, disease, parasitism); assess reproductive status (e.g., spawning success, recruitment, age/size-dependent fecundity); develop new sampling techniques and gear for collecting early life history stages; assess gametogenesis (timing of maturation, frequency of spawning), including effects of environmental factors on gonadal development; and define physical habitat requirements (substrate, flow, water quality) for spawning. 2 references, 2 figures, 5 tables.

34352 **(DPST—82-808) Water flow statistics: SRP creeks.** Lower, M.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 26 Aug 1982. Contract AC09-76SR00001. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013155.

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For a number of environmental studies it is necessary to know the water flow rates and variations in the SRP streams. The objective of this memorandum is to pull together and present a number of statistical analyses for Upper Three Runs Creek, Four Mile Creek and Lower Three Runs Creek. The data basis covers 8 USGS stream gage stations for the years 1972 - 1981. The average flow rates over a ten-year period along Upper Three Runs Creek were determined to be 114 cfs at US Route 278, 193 cfs at Road C, and 265 cfs at Road A. Along Four Mile Creek the average flow rates over a ten-year period doubled from 9 cfs prior to F-Area discharges to 18 cfs prior to cooling water discharges from C-Area Reactor. Finally, average flow rates along Lower Three Runs Creek over a ten-year period tripled from 32 cfs at Par Pond to 96 cfs near Snelling, South Carolina. 1 figure, 9 tables.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 32666, 32752, 32753, 32754, 33822, 33935, 34234, 34236, 34283, 34303, 34318, 34433, 34490

34353 **(DTH-ISVA-PR—57) Progress report No. 57 [on hydrodynamics and hydraulic engineering].** (Danmarks Tekniske Hoejskole, Lyngby. Inst. for Stroemningsmekanik og Vandbygning). 1982. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770195.

Individual papers are included in the data base.

34354 **(EPRI-CS—3343) Symposium on condenser macrofouling control technologies: the state of the art.** Diaz-Tous, I.A.; Miller, M.J. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA)). Dec 1983. 591p. (CONF-8306181—). EPRI-Research Reports Center, Box 50490, Palto Alto, CA 94303. Order Number TI84920275.

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

This report is divided into five parts corresponding to the five symposium sessions in which formal presentations and discussions were held. Session 1 discussed the nature of macrofouling problems in general and their impact on power plant operation. Session 2 discussed chemical control technologies, basically chlorine minimization, continuous low-level chlorination, cost of chlorination for the utility industry, and the effects of organotins on marine organisms. Session 3 discussed international experiences (from the United States, France, Germany and the Netherlands) with mechanical controls such as intake screening, in-line filters, and thermal backwash. Alternate control technologies, including antifouling coatings and sheetings, nontoxic sheetings, acoustical, velocity, and Cathelco, were discussed in Session 4. Session 5 consisted of information exchange workshops on utility experience with mechanical and chemical controls. The workshop's notes are presented in this report. Papers presented at the symposium are included. Each paper has been indexed separately for inclusion in the Energy Data Base.

34355 **(KFK—3611) Investigations on the dissociation of high molecular organic compounds in natural water.** Ackermann, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). Dec 1983. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751287.

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Macromolecular humic acid from water of the Hohlohsee in the Northern Black Forest and of the river Rhine were isolated. The chemical structure and the ionization of these humic acids and of lignosulfonic acid were investigated. Chemical procedures used for the blocking of the function groups and IR-spectra showed that hydroxy- and carboxy-groups are present in humic acid and sulfonic- and phenolic-groups in lignosulfonic acid. SEM micrographs identified fibre-structures (diameter: 0.1 μm, lengths: 100 μm) in humic acid. The determination of dissociation from potentiometric titration curves was done using a nonlinear regression program. Humic and lignosulfonic acid can be described as a multibasic acid (Hsub(n)X). On the other side the ionization can also be described as a model of isolated monobasic acid groups. A mixture of organic acids with well known dissociation constants was used to simulate a

titration surve of humic acide. The dependence of the dissociation constants of humic acid on temperature and ionic strength is similar to organic acids as citric acid.

34356 **(LBL—15701) Study of contaminant plume control in fractured-porous media.** Tsang, Chin Fu; Mangold, D.C.; Doughty, C.; Javandel, I. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 25p. (CONF-830561—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013392.

From 3. national symposium on aquifer restoration and ground water monitoring; Columbus, OH, USA (25 May 1983).

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Mathematical modeling studies have been made on the control, containment, and removal of contaminant plumes in water-saturated, fractured, porous media. Two approaches have been investigated from a hydrological point of view. The first considers one or more low-permeability barriers to contain the plume and to prevent it from being carried away by natural, regional groundwater flow. The second studies various plume extraction schemes using a pumping well. Heterogeneous and fractured aquifers are considered as well as a contaminant plume that is heavier than the groundwater. General discussions on the effectiveness and limits of the various plume control procedures are discussed. 4 references, 13 figures, 3 tables.

34357 **(NUREG/CR—3476) Chemicals in effluent waters from nuclear power stations: the distribution, fate, and effects of copper.** Harrison, F.L. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 61p. (UCRL—53486). NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. Order Number DE84013533.

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This report provides a summary of research performed to determine the physicochemical forms and fate of copper in effluents from power stations adjacent to aquatic ecosystems with water that differs in salinity, pH, and concentrations of organic and inorganic constituents. In addition, research performed to evaluate responses of selected ecologically and economically important marine and freshwater organisms to increased concentrations of soluble copper is reviewed. The same parameters were measured and the same analytical techniques were used throughout the study. Copper concentration and speciation, in influent and effluent waters collected from eight power stations using copper alloys in their cooling systems, showed that the quantities of copper associated with particles, colloids, and organic and inorganic ligands differed with the site, season, and mode of operation of the station. Under normal operating conditions, the differences between influent and effluent waters were generally small, and most of the copper was in bound (complexed) species except when low pH water was circulated. However, copper was high in concentration and present in labile species during start-up of water circulation through some cooling systems and during changeover from open-cycle to closed-cycle operation. The toxic response to copper differed with the species and life stage of the organism and with the chemical form of copper in the water. Our primary emphasis was on acute effects and most of the testing was performed under controlled laboratory conditions. However, sublethal effects of copper on a population of bluegills living in a power station cooling lake containing water of low pH and on a population exposed to increased soluble copper in the laboratory were also assessed. 105 references, 15 figures, 11 tables.

34358 **(PB—84-172204) Contamination of ground and surface waters by uranium mining and milling. Volume 3. Experimental studies and analytical procedures. Open file report 25 Jul 79-14 Sep 81.** Runnells, D.D.; Gerlitz, C.N.; Davis, A.; Lindberg, R.D.; Meglen, R. (Colorado Univ., Boulder (USA)). 15 Sep 1983. 230p. NTIS, PC A11/MF A01.

Supplement to PB82-251992, and PB83-170688.

The objective of this study was to measure the degree of retardation of the important chemical species in fluid from a uranium tailings pile as the fluid passed through cores taken from rock underlying the tailings pile. The measurements indicated that pH was the dominant control on the behavior of these species, and that the pH was affected primarily by the calcite cement in the rocks. The most appropriate species for monitoring were sulfate, chloride, and selenium. An appendix provides a description of the advantages and disadvantages of the various analytical procedures used on these high-ionic strength solutions.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 32753, 32758, 32759, 34298, 34301, 34302, 34303, 34304, 34311, 34312, 34313, 34315, 34316, 34317, 34318, 34331

34359 **(CEA-BIB—238) Bibliographical survey of radiostrontium uptake capacity and processes in aquatic plants.** Pally, M.; Foulquier, L. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Sep 1983. 282p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84751552.

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This report covers 302 articles published between 1949 and 1980 on the contamination of freshwater and marine aquatic plants by radioactive strontium. For the marine and continental environments, the results of laboratory experiments on the dynamics of radiostrontium buildup and localization, concentration factors, elimination processes, the effects of biological factors and of the environment, the activity levels and concentration factors measured in areas directly and indirectly affected by waste discharges, discrimination factors and the role of plants as radiation indicators, are examined. The radioactive strontium uptake potentials are higher for freshwater plants -especially mosses and characeae- than for marine plants. In zones not directly affected by waste discharges, the maximum activity measured is 82 pCi/kg wet weight, compared with 750 pCi/kg for freshwater plants. The peak values were observed in 1964-1965. In zones directly affected by waste discharges, the activity levels range from 15 to 1700 pCi of ^{90}Sr per kilogram of wet weight in the marine environment, and from 20 to 207000 pCi/kg in fresh water. This work underlines the need for greater accuracy in allowing for the ecological characteristics of each site when assessing the impact of nuclear facilities, and for thoroughly correlating field observations with laboratory experiments in order to obtain a prospective view of the potentials for radioactive strontium uptake by plants according to the activity levels present in the liquid effluents.

34360 **(DPST—70-435) Radioactivity in the environs of Steel Creek.** Marter, W.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 20 Aug 1970. Contract AC09-76SR00001. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013150.

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All reactor cooling water discharges to Steel Creek ceased when L Area reactor was shut down in February, 1968. Since that time, only L and P Area disassembly basin purges, undiluted by cooling water, have been discharged to the creek. This has resulted in higher concentrations of radioactive materials (primarily ^{134}Cs ^{137}Cs from a few failed experimental fuel elements) in the stream water, even though the quantity of radioactive materials released to the creek has been decreasing since 1968. With reduced water flow, portions of the old creek bed are now exposed and support contaminated vegetative growth that is available for forage by deer. The creek water, now thermally cool, is an attractive habitat for fish and ducks. The maximum concentrations of ^{137}Cs detected in the flesh of deer, duck, and fish living in or near the creek are 204 pCi/g, 924 pCi/g, and 3500 pCi/g, respectively. 8 tables.

34361 **(NUREG/CR—2424-Vol.1) Mathematical simulation of sediment and radionuclide transport in coastal waters. Volume 1. Testing of the sediment/radionuclide transport model, FETRA.** Onishi, Y.; Thompson, F.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 112p. (PNL—5088-1-Vol.1). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013535.

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The finite element model, FETRA, is an unsteady, two-dimensional (longitudinal and lateral) model for simulating the transport of sediment and contaminants (e.g., radionuclides, heavy metals, pesticides) in coastal waters. FETRA includes major transport and fate mechanisms explicitly, including sediment/contaminant interactions. The purpose of the study was to test FETRA

model with available field data and was not intended to assess the potential impact of the Windscale Nuclear Fuel Reprocessing Plant on the Irish Sea. The model was tested by applying it to the Irish Sea to simulate wind-generated waves and the migration of sediment and ^{137}Cs. The model predicted distributions of suspended sand; suspended silt; suspended clay; ^{137}Cs sorbed by each of the three sizes of suspended sediments; dissolved ^{137}Cs; bed sediment size fractions; and ^{137}Cs sorbed by bed sand, bed silt, and bed clay over a two-month period in 1974. FETRA generally predicted reasonable migration patterns for the sediments and ^{137}Cs. The prediction of ^{137}Cs distributions can be further improved by using a finer grid near the radionuclide release point. The study results indicate that FETRA can simulate the complex phenomena involved in sediment and contaminant transport in coastal waters. However, we recommend that FETRA be tested further at other field sites where the necessary field data are available to validate the model. 47 references, 64 figures, 4 tables.

34362 **(NUREG/CR—2424-Vol.2) Mathematical simulation of sediment and radionuclide transport in coastal waters. Volume 2. User's manual and computer program listing for FETRA.** Onishi, Y; Thompson, F.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 90p. (PNL—5088-1-Vol.2). NTIS, PC A05/MF A01; 1 - GPO $4.50; GPO Dep. Order Number DE84013759.

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FETRA is a finite element model for simulating the sediment and contaminant transport to surface water. The model was applied to a test site in the Irish Sea and modified to account for wave mechanisms that effect sediment suspension. The model consists of three submodels that are coupled to simulate sediment/contaminant interactions. The submodels simulate 1) sediment transport, 2) dissolved contaminant transport, and 3) particulate contaminant (those contaminants absorbed by sediment) transport. Volume 1 of this report discusses the application of FETRA to the Irish Sea study area to simulate the effect of wind-generated surface waves on the transport of sediment, dissolved ^{137}Cs, and particulate ^{137}Cs. Volume 2 presents a very brief users guide for FETRA in Chapter 2 and a computer program listing of FETRA in Appendix A.

34363 **(ORNL/TM—8682) Investigation of the concentration, distribution, and inventory of radionuclides in the sediment of Process Waste System Basin 3524.** Braunstein, H.M.; Alexander, W.A.; Hubbard, H.M.; Oakes, T.W.; Ohnesorge, W.F. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 44p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013605.

Process Waste System Basin 3524 is used as a collection basin for process liquid waste from facilities at the Oak Ridge National Laboratory. This investigation was conducted to determine the radionuclide concentrations, distributions, and inventory of the sediments in this basin in preparation for future decontamination and decommissioning activities. Twenty-four sediment cores were extracted from the basin and 80 aliquots were analyzed for their radionuclide concentrations. The sediment is estimated to contain a total of 5.5×10^{12} Bq (150 Ci) of activity, 87% of which is contributed by two radionuclides, ^{137}Cs (68%) and ^{90}Sr (19%). The radionuclide content is estimated as follows: ^{137}Cs, 3.77×10^{12} Bq (102 Ci); ^{90}Sr, 1.07×10^{12} Bq (29 Ci); gross alpha, 4.06×10^{11} Bq (11 Ci); ^{241}Am, 1.70×10^{11} Bq (4.6 Ci); ^{60}Co, 8.32×10^{10} Bq (2.2 Ci); and ^{154}Eu, 3.35×10^{10} Bq (0.9 Ci). 9 references, 8 figures, 7 tables.

34364 **(PB—84-145531) Sedimentation studies relevant to low-level radioactive effluent dispersal in the Irish Sea. Part 1. Radionuclides in marine sediments.** Smith, T.J.; Parker, W.R.; Kirby, R. (Institute of Oceanographic Sciences, Godalming (UK)). 1980. 91p. NTIS, PC E06/MF E06.

Certain elements, particularly plutonium and americium, small quantities of which are routinely discharged into the marine environment from nuclear fuel reprocessing plants rapidly became associated with the sea bed sediments. This report examines the discharge of various radionuclides into the Irish Sea with particular reference to the interaction between the radionuclides and the sediments. A review of the relevant literature has revealed a variety of possible interaction mechanisms which are sensitive to many environmental parameters. Measurements of radionuclide distributions have previously been used to infer rates of sedimentary processes. The assumptions underlying these interpretations are considered and it is shown that a large amount of information on the sedimentological regime of a given area is required before confident interpretations of radionuclide distributions can be made. This background material is only partially available for the Irish Sea.

34365 **(SCPRI-RT—1-1983) 1. Quarterly progress report 1983.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1983. 34p. (In French). NTIS (US Sales Only), PC A03. Order Number DE84751577.

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This report of the SCPRI interpretes the principal results of the surveillance of radioactivity in the environment: atmospheric dusts, rainwater, surface water, underground water, irrigation water, drinking water, food chain, sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs, ^{90}Sr, ^{106}Ru, K, ^{54}Mn, U and T). A bibliographic selection is also presented.

34366 **(SCPRI-RT—2-1983) 2. Quarterly progress report, 1983.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Aug 1983. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751587.

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This quarterly report of the SCPRI interpretes the principal results of the surveillance of radioactivity in the environment: atmospheric dusts, rainwater, surface water, underground water, irrigation water, drinking water, food chain, sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs, ^{90}Sr, ^{106}Ru, K, ^{54}Mn, U and T). A bibliographic selection is also presented.

34367 **(SCPRI-RT—4-1982) 4. Quarterly progress report, 1982.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1982. 34p. (In French). NTIS (US Sales Only), PC A03. Order Number DE84751566.

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This quarterly report of the SCPRI interpretes the principal results gained by surveillance of radioactivity in the environment: atmospheric dusts, rainwater, surface water, underground water, irrigation water, drinking water, food chain, sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs, ^{125}Sb, ^{90}Sr, ^{106}Ru, K, ^{54}Mn, U and T). A bibliographic selection is also presented.

34368 **Measurement of radionuclide diffusion in ocean floor sediment and clay.** Schreiner, F.; Fried, S.; Friedman, A.M. (Argonne National Laboratory Chemistry Division, 9700 South Cass Avenue, Argonne, Illinois 60439). *Nuclear Technology;* **59**: No. 3, 429-438(Dec 1982).

The mobility of cationic neptunium, plutonium, americium, and sodium, and of the anionic species pertechnetate, TcO^{-}_{4}, has been determined in samples of various sediments from the ocean floor, and in bentonite and hectorite clay. The experiments were conducted at ambient temperatures (298 + or - 5 K), and the periods of observation ranged from several hours to ten months. All tests were carried out under static conditions permitting only molecular diffusion of the ionic species. Results indicate very low mobilities for the transuranium elements plutonium and americium, for which the upper limit of the effective diffusion coefficient is $<10^{-10}$ $cm^{2}xs^{-1}$. Sodium, neptunium, and TcO^{-}_{4} were found to have higher mobilities characterized by values for the effective diffusion coefficient of 3×10^{-6}, 1.8×10^{-6}, and 3.2×10^{-6} $cm^{2}xs^{-1}$, respectively. Some implications of the measured results for the assessment of barrier effectiveness are discussed.

34369 **The influence of speciation on the geospheric migration of radionuclides.** Hadermann. (Swiss Federal Institute for Reactor Research CH-5303 Wurenlingen). *Nuclear Technology;* **56**: No. 1, 102-105(Jan 1982).

Radionuclides in groundwater can exist as different species whose retention factors may be strongly different. For one-dimensional transport in a porous medium, we give conditions for the existence of equilibrium between two species. In most cases, these conditions are probably well fulfilled when time scales of geosphere transport are considered. In these cases, the total concentration migrates independently of a particular speciation with an effective retention factor. Such an effective retention factor can also be defined if more than two species in liquid phase are in equilibrium. As a consequence, existing radionuclide transport models can be readily used by properly redefining the retention factor.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 33242, 34370

5205 Site Resource And Use Studies

34370 **(DPST—84-445) Interim report of the Savannah River macroinvertebrate and periphyton studies.** Specht, W.L.; Kania, H.J.; Painter, W.B. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Sep 1983. Contract AC09-76SR00001. 69p. (ECS-SR—6). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013148.

A total of 231,421 macroinvertebrates were collected from Hester Dendy multiplate samplers placed at five locations in the Savannah River and three tributary streams (Upper Three Runs Creek, Four Mile Creek and Steel Creek) between September 1982 and March 1983. Forty-nine taxonomic groups, including 41 insect families and 8 non-insect taxa were collected from the samplers. The creeks contained significantly fewer invertebrate taxa and lower densities of macroinvertebrates than did the river. More invertebrate taxa, but lower densities of organisms were collected from bottom Hester Dendy samplers than from those placed near the surface. No significant differences were found between the macroinvertebrate communities of samplers placed near the South Carolina or Georgia banks of the river. No substantive conclusions can be drawn from the first six months of periphyton data from sampling locations in the Savannah River. However, data from the creeks indicate that thermal discharges into Four Mile Creek stimulate periphyton production during the winter months. 17 references, 8 figures, 3 tables.

5206 Regulations

REFER ALSO TO CITATION(S) 34331

34371 **(PB—84-151448) SO2 emissions in natural gas production industry: background information for proposed standards. Draft environmental impact statement.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Nov 1983. 438p. (EPA—450/3-82-023A). NTIS, PC A19/MF A01.

Standards of performance for the control of SO2 emissions from natural gas sweetening operations are being proposed under Section III of the Clean Air Act. This document contains background information and environmental and economic impact assessments of the regulatory alternatives considered in developing the proposed standards.

34372 **(PB—84-156397) Report to Congress: nonpoint source pollution in the U.S. Final report Sep 83-Jan 84.** (Environmental Protection Agency, Washington, DC (USA). Office of Water Program Operations). Jan 1984. 145p. NTIS, PC A07/MF A01.

Prepared in cooperation with Synectics Group, Inc., Washington, DC.

The report examines the nature and magnitude of nonpoint source water quality problems in the U.S. and outlines the key components of state strategies to prevent and control such pollution. The focus of the report is the identification of high-payoff approaches that are likely to result in the greatest water quality improvements.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 32719

34373 **(BMFT-FB-HA—84-011) Study of sound propagation as a function of roadway shape, cross-section and support.** Langebrake, F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1984. 170p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84751772.

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Limited cross-sections of roadways and other workings in underground mines cause higher noise levels of machines in underground application compared to surface application. The measuring of noise levels in underground mines is rather complicated: protective regulations against fire-damp explosion have to be obeyed, environmental conditions like air humidity, dust, etc. are a hinderance to measuring. A planned law of the government will enforce the marking of machines with their sound power level. The underground noise level can be calculated if the surface noise level is known. In this research projekt factors have been defined on the basis of comparative underground and surface measurements carried out with a noise source - regarding underground special conditions and noise propagation. Surface and underground control measurements at mining machines proved the availability of these factors for the prediction of underground sound pressure levels.

34374 **(NP—4770330) Investment and cost functions for measures serving the reduction of emissions on the sector of energy conversion.** Hempelmann, R. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Wirtschaftswissenschaften). 8 Nov 1982. 367p. (In German). NTIS (US Sales Only), PC A16/MF A01. Order Number DE84770330.

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This book is concerned with: - general boundary conditions on the sector of energy and environment and the limitations resulting from it, - the empiric recording and aggregation of technological data and investment/cost data for the sector of energy conversion, - setting-up techno-economic cost functions for measures serving the reduction of emissions, i.e. the linking of economic data with certain "essential" technical design/dimensioning criteria in order to determine emission-induced investment/cost on the sector "Power plants", - working out an applicable method for the practical quantification of these investments/costs for particulate and gaseous air pollution components (sulphur dioxide (SO_2), and nitric oxide (NOsub(x)), which are - quantity wise - of determining importance on the sector "Power Stations".

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 32493

55 BIOMEDICAL SCIENCES, BASIC STUDIES

REFER ALSO TO CITATION(S) 33445

5502 Biochemistry

REFER ALSO TO CITATION(S) 32779, 32798, 34390, 34440, 34556

34375 (BNL—34634) Undecagold labelling of glutamine synthetase from E. Coli. Lipka, J.J.; Hainfeld, J.F.; Wall, J.S. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 3p. (CONF-840848—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010285.

From 42. annual Electron Microscopy Society of America meeting; Detroit, MI, USA (13 Aug 1984).

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Glutamine synthetase (GS) from E. coli consists of 12 identical 50 kD subunits arranged in a double hexagon with one six-fold axis of rotational symmetry and six two-fold axes. The divalent cations Mn^{2+} or Co^{2+} induce the formation of linear face-to-face aggregates of individual GS molecules, resulting in the formation of long linear arrays, GS. We have used an undecagold (11-Au) cluster ion, $((p\text{-}H_2NCH_2C_6H_4)_3\text{-}P)_7Au_{11}^{3+}$, which induces similar aggregation of native GS, resulting in a wide distribution of ordered linear arrays of GS/sub n/. These aggregates show the highly electron dense labels located exclusively at the face-to-face interaction surface. Specimens of the GS/sub n/ aggregates have been studied with the Brookhaven STEM and molecular weight values have been determined with the Brookhaven STEM mass measurement computer system. 7 references, 1 figure, 2 tables.

34376 (BNL—34648) Alignment of low dose stem images of unstained macromolecules. Hainfeld, J.F.; Furcinitti, P.S.; Wall, J.S. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 3p. (CONF-840848—1-Abst.). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010796.

From 42. annual Electron Microscopy Society of America meeting; Detroit, MI, USA (13 Aug 1984).

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Scanning transmission electron microscopy can provide low dose, high contrast images of unstained material with high collection efficiency. We have used the MDPP image analysis system implemented on an LSI-11/23 computer to align images of unstained glutamine synthetase molecules taken at various doses. A series of 3 el/A^2 dose images with 10A sampling are shown. 5 references, 6 figures.

34377 (BNL—34662) Toward the biochemistry of individual molecules. Wall, J.S.; Hainfeld, J.F. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 5p. (CONF-840848—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84011564.

From 42. annual Electron Microscopy Society of America meeting; Detroit, MI, USA (13 Aug 1984).

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Mass measurement by scanning transmission electron microscopy (STEM) has been established as a sensitive and uniquely powerful technique for structure studies. The STEM excels for isolated particles above 10^6 Daltons, for interacting systems and for filaments or sheets. Domainal analysis adds even greater power, especially when the particle of interest can be aligned to permit image averaging. In that case the detectable change in mass can be made arbitrarily small by averaging enough particles. Mass can be subtracted by proteolysis or added by binding substrate, heavy atoms or other reagents. An example of this is mapping the ATP binding site of glutamine synthetase by comparison of labeled and unlabeled molecules. 17 references, 1 figure.

34378 (BNL—34679) Protein structure is only as good as the data. Schoenborn, B.P. (Brookhaven National Lab., Upton, NY (USA)). 01 Jun 1984. Contract AC02-76CH00016. 19p. (CONF-8206240—8). NTIS, PC A02; 1; GPO Dep. Order Number DE84012904.

From Brookhaven symposium biology 32; Upton, NY, USA (1 Jun 1982).

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Careful selection of the best diffraction geometry matched to the sample, with use of high resolution two-dimensional detectors and a mask integration procedure will allow the collection of statistically accurate data for many proteins and crystals with a sample size of at least 1 mm^3. Accurate data and improved refinement techniques will allow the determination of all atoms including hydrogens, hydrogen-deuterium exchange, water of hydration, and solvent water densities. The developments in the above described neutron techniques have been gradually used in the analysis of myoglobins, gramicidin, trypsin, and crambin. 16 references, 11 figures, 2 tables.

34379 (BNL—34680) Neutron structure of the hydrophobic plant protein crambin. Teeter, M.M.; Kossiakoff, A.A. (Boston Univ., MA (USA). Dept. of Chemistry; Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 15p. (CONF-8206240—9). NTIS MF A01; 2; GPO Dep. Order Number DE84012914.

From Brookhaven symposium biology 32; Upton, NY, USA (1 Jun 1982).

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Crystals of the small hydrophobic protein crambin have been shown to diffract to a resolution of at least 0.88 A. This means that crambin presents a rare opportunity to study a protein structure at virtually atomic resolution. The high resolution of the diffraction pattern coupled with the assets of neutron diffraction present the distinct possibility that crambin's analysis may surpass that of any other protein system in degree and accuracy of detail. The neutron crambin structure is currently being refined at 1.50 A (44.9% of the data to 1.2 A has also been included). It is expected that a nominal resolution of 1.0 A can be achieved. 15 references, 6 figures, 2 tables.

34380 (DOE/SF/00034—1) Time-resolved laser studies on the energy transfer and the configurational changes in bacteriorhodopsin. Progress report, December 1, 1981-November 30, 1984. El-Sayed, M.A. (California Univ., Los Angeles (USA). Dept. of Chemistry and Biochemistry). 1984. Contract AT03-76ER70278. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013466.

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Using time-resolved photoselection techniques, it has been determined that the daughter transition moment following photon absorption is found to be parallel to that of the absorbing parent. This suggests rapid photochemistry and thus eliminates the possibility of energy migration. In bacteriorhodopsin, retinal changes its configuration on the picosecond time scale. This enabled authors to develop a new technique to determine the resonance Raman spectrum of picosecond transients. Tryptophan fluorescence intensity was followed as bacteriorhodopsin passes through its different intermediates. No change in fluorescence was observed during the rapid initial steps ($bR_{560} \rightarrow K_{610}$). However, a decrease in the fluorescence intensity took place in the $K_{610} \rightarrow L_{550}$ step and a further decrease took place in the $L_{550} \rightarrow M_{412}$. 13 references.

34381 (LA-UR—84-430, pp 2-31) Solitons in biology. Lomdahl, P.S.; Layne, S.P.; Bigio, I.J. 1984. NTIS, PC A05/MF A01. Order Number TI84011404.

In Los Alamos Science, Number 10, Spring 1984.

In 1973 scientists gathered at the New York Academy of Sciences to discuss an unanswered question in bioenergetics: how is chemical energy transduced and transported in biological systems. In the same year a Soviet solid-state physicist proposed a dynamic answer that was totally novel to the world of biology. Exploiting the regularity in the structure of α-helical proteins, he showed that simplified models of these proteins could self-focus, or trap, energy in stable, pulse-like waves known as solitons. If self-focusing is indeed a biological reality, it may account for many aspects of protein behavior, including the efficient transport of energy. This possibility is being studied at Los Alamos through analytical, numerical, and experimental techniques. 13 references, 17 figures.

34382 (LBL—17768) C_4 photosynthesis in Euphorbia degeneri and E. remyi: a comparison of photosynthetic carbon metabolism in leaves, callus cultures and regenerated plants. Ruzin, S.E. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 151p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84013238.

Thesis.

Based on analysis of $^{14}CO_2$ fixation kinetics and assays of enzymes related to C_4 metabolism (NAD-ME, NADP-ME, NAD-MDH, NADP-MDH, AST, ALT), leaves and regenerated plants of Euphorbia degeneri exhibit a modified NADP-ME-type photosynthesis. Apparently, both aspartate and malate are used for transport of CO_2 to bundle sheath cells. Callus grown on either non-shoot-forming or shoot-forming media fixes CO_2 into RPP-cycle intermediates and sucrose, as well as malate and aspartate. $^{14}CO_2$ pulse/chase kinetics show no significant loss of label from C_4 acids throughout a one minute chase. Analysis of PEPCase revealed the presence of 2 isoenzymes in both leaf and regenerated plant tissues (K/sub m/ [PEP] = 0.080 and 0.550) but only one isoenzyme in callus (K/sub m/ = 0.100). It appears that C_4 photosynthesis does not occur in callus derived from this C_4 dicot but is regenerated concomitant with shoot regeneration, and β-carboxylation of PEP in callus, mediated by the low K/sub m/ isoenzyme of PEPCase, produces C_4 acids that are not involved in the CO_2 shuttle mechanism characteristic of C_4 photosynthesis. 161 references, 19 figures, 12 tables.

34383 (PB—84-162239) Acid rain and forest decline in West Germany. Binns, W.O.; Redfern, D.B. (Forestry Commission, Edinburgh (UK)). 1983. 17p. NTIS, PC E03/MF E03.

The report discusses the concern being shown throughout Europe concerning the possible effects of acid rain and metal pollution on aquatic and terrestrial ecosystems. In particular, studies are examined in which soil changes in Germany due to acid rain have reportedly caused dieback of several tree species. Acid precipitation was thought to increase soil acidity to the extent that root damage increases allowing bacteria to enter and cause 'wetwood' which leads to crown desiccation. The findings are detailed of visits to a number of forest areas in Germany to evaluate the dieback of spruce and fir, and to judge its relevance to Great Britain.

5503 Cytology

34384 (INIS-mf—8737) ^{3}H-thymidine autoradiographic study of cell proliferation and the influence of isoproterenol and kallikrein in various cell populations of the gastrointestinal tract in animal experiments. Albrecht, S. (Hamburg Univ. (Germany, F.R.). Fachbereich Medizin). 1 Dec 1981. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780345.

Diss. (Dr.med.).

Morphological studies were carried out with the aim of studying cell proliferation in various tissues (stable and epithelial tissues) of the gastrointestinal tract. The cells were studied by ^{3}H thymidine autoradiography in the normal age cycle and under the influence of kallikrein or isoproterenol. Epithelial cells and smooth muscle cells of the forestomach, stomach, small intestine and colon were investigated and, in the case of the stomach, also connective-tissue cells of the mucotic stroma. Counts across the total epithelial thickness yielded similar results for the esophagus and the forestomach. A count of 1000 cells per animal was found to yield representative information on a defined type of cell. Kallikrein was not found to have a constant mitosis-promoting effect. Isoproterenol caused the labelling index to increase or to decrease; in higher concentrations, it increased the proliferation rate in all cell types. In male animals, the labelling indices of connective-tissue cells of the gastric mucosa were significantly higher than in female animals. (orig./MG).

34385 (LA-UR—84-1688) Model for antibody mediated cell aggregation: rosette formation. Perelson, A.S. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840870—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012446.

From Symposium on mathematics and computers in biomedical applications; Bethesda, MD, USA (6 Aug 1984).

Portions are illegible in microfiche products.

Models are developed for the formation of cellular aggregates, called rosettes, composed of a central lymphocyte and surrounding antibody coated red blood cells. Kinetic and equilibrium models are considered from both the deterministic and stochastic viewpoints. Analytic solutions are given to the system of nonlinear ordinary differential equations that describe the formation of different size rosettes in the cases of both reversible and irreversible red cell adhesion. A comparison of the stochastic model with experimental data indicates that there may exist heterogeneity within the lymphocyte population with regard to the number of chemical bonds required to bind a red cell to a lymphocyte. 24 references, 2 figures.

34386 Water relations of cacti during desiccation: distribution of water in tissues. Barcikowski, W.; Nobel, P.S. (Univ. of California, Los Angeles). *Botanical Gazette (Chicago);* **145**: No. 1, 110-115(Mar 1984). Contract AC03-76SF00012.

Three species of cacti survived an average stem water loss of 81%. Fractional water loss was greater from water-storage tissue than from the chlorenchyma, as documented at the cellular level by determining changes in cell volume and at the tissue level by determining relative water content of chlorenchyma and storage tissues. For Carnegiea gigantea and Ferocactus acanthodes, this differential loss of water resulted from a decrease in the moles of solute per cell for storage tissue; hence, less water was retained at a given osmotic pressure than for the chlorenchyma. Opuntia basilaris lost less water from the chlorenchyma during drought because of a greater initial osmotic pressure in the chlorenchyma than in the storage tissue. Greater retention of water in the chlorenchyma would result in less disruption of photosynthetic activity in these cacti during drought.

5504 Genetics

REFER ALSO TO CITATION(S) 34430

34387 (INIS-mf—8725) Measurement of DNA strand break repair and survival rate after X-irradiation of synchronized CHO cells. Graubmann, S. (Hamburg Univ. (Germany, F.R.). Fachbereich Physik). 22 Sep 1981. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780341.

The author investigated the induction and repair of DNA strand breaks and the survival rate of CHO cells after X-radiation at different stages of the cell cycle. His particular concern was the interdependence between cell inactivation and double strand break repair. (orig./AJ).

34388 Directed genetic modification of potentially useful microorganisms. Lidstrom, M.E. (Univ. of Washington, Seattle). *Biotechnology and Bioengineering Symposium;* No. 13, 239-244(1983). (CONF-830567—). Contract AM06-76RL02225.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

With the development of plasmid technology and recombinant DNA techniques, it is now possible to specifically modify strain characteristics. With these capabilities it is possible to move specific and recoverable DNA fragments from one organism to another and to obtain large quantities of specific DNA fragments. In addition, it is possible to study and alter DNA sequences in vitro using sophisticated approaches that have never before been possible. The potential these techniques hold for commercial applications is impressive and has, in part, fueled the current interest in biotechnology. Unfortunately, these techniques have not been developed in many of the most commercially attractive microorganisms. Much effort is now needed to apply recombinant DNA technology to commercially important strains. This paper describes the genetic strategies one laboratory has used to study one group of commercially important microorganisms, the methylotrophic bacteria. The approach serves to illustrate how recombinant DNA tech-

niques can be applied to strains with no prior genetic capabilities. Some of the applications of this technology are summarized. 19 references, 2 figures, 2 tables.

34389 **Apomictic and sexual pearl millet X Pennisetum squamulatum hybrids.** Dujardin, M.; Hanna, W.W. (USDA, Tifton, GA). *Journal of Heredity;* 74: 277-279(1983). Contract AS09-76EV00637.

Pennisetum squamulatum Fresen, an apomictic East African grass (2n = 54) was crossed to tetraploid (2n = 28) sexual pearl millet, P. americanum L. Leeke to study the potential for germplasm exchange. Twenty interspecific hybrids (2n = 41) with 14 pearl millet and 27 P. squamulatum chromosomes were obtained. All resembled P. squamulatum in perennial growth habit and inflorescence characteristics and resembled pearl millet in leafiness and pencillate anther tips. Seventeen of these hybrids were more vigorous than either parent. The most common chromosome association at metaphase I was 18 bivalents plus 5 univalents. At anaphase I and telophase I laggards, fragments, and unequal chromosome distribution were observed. Fifteen of 17 interspecific hybrids reproduced by facultative apomixis, one was sexual and one was an obligate apomict. Ovules with aposporous embryo sacs ranged from 1 to 93% in facultative apomictic plants. Morphological characteristics and chromosome numbers of open-pollinated progeny from the apomictic interspecific hybrid were identical to those of the seed parent indicating obligate apomictic reproduction. Both sexual and apomictic hybrids were partially male fertile with pollen stainability ranging from 29 percent to 79 percent and seed-set ranging from 1 to 60 seed per inflorescence under open-pollination. Development of fertile apomictic pearl millet-P. squamulatum interspecific hybrids appears to be a very useful tool for the transfer of genes for apomixis from the wild species to pearl millet.

34390 **Genetic control of tRNA methylation in inbred mice.** Dizik, M.; Wainfan, E. (New York Blood Center, New York). pp 399-403 of Biochemistry of S-adenosylmethionine and related compounds. Usdin, E.; Borchardt, R.T.; Creveling, C.R. (eds.). New York, NY; MacMillan Press (1982).

The tRNA methyltransferases from widely divergent species differ in their activity levels and base specificities. However, very little is known about intra-species differences in activities of these enzymes except for those found in bacterial mutants which lack certain base-specific tRNA methylases and in rat liver tRNA methylases which exhibit sex specific activity differences. In order to learn whether there are genetically determined intra-species differences in mammalian tRNA methyltransferases, the authors are investigating various characteristics of these enzymes in inbred strains of mice. Since the tRNA methyltransferases are known to have altered activities in tumors and during chemically induced carcinogenesis it seemed of interest to compare the enzymes from inbred mice with either high (AKR/J) or low (C57BL.6J) incidence of spontaneous leukemia.

5505 Metabolism

REFER ALSO TO CITATION(S) 33841, 34477

34391 **(INIS-mf—8356) Comparative digoxin determination in serum by means of a radioimmuno- and an enzyme immunoassay. Clinical importance, comparison of methods examining sensitivity, accurateness and precision.** Reinhard, M. (Marburg Univ. (Germany, F.R.). Fachbereich Humanmedizin). 26 Jun 1981. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780307.

Two immunologic measuring methods for the quantitative digoxin determination in serum were compared. One method bases on the principle of radioisotope dilution, the second one on the principle of enzyme inhibition. The radioimmunoassay served as reference method. The limit of detection for RIA is 0.23 ng/ml, for EIA 0.40 ng/ml. For both methods the measuring range extends up to approx. 5.5 ng/ml. The degree of precision in series is 8.2% for RIA, 10.8% for EIA. Day-to-day precision is 4.4% for RIA, 15.2% for EIA. On comparison, the 59 serum samples of patients who received digoxin did not show any systematic difference. The results obtained can be transformed by means of the equations Csub(EIA) = 0.041 ng/ml + 0.936 Csub(RIA). In pathologic sera, however, there are significant differences disfavoring EIA, because due to high color concentrations or turbidities these sera do not permit any or any exact extinction measurements. The enzyme immunoassay should not be used with such sera. With regard to practicability the EIA corresponds more or less to RIA. The EIA can essentially be economized by using semi-microcuvettes and applying only the half of the recommended enzyme and antibody volume. (orig.).

34392 **(PB—84-163765) Intravenous elimination and percutaneous absorption of topically applied Methotrexate-^{14}C (NSC 740) in Yorkshire White pigs. Report for Oct-Dec 78.** Skierkowski, P.; Murphy, J.C.; Wirth, P.W.; Miller, T.J.; Folk, R.M. (Battelle Toxicology Program Office, Vienna, VA (USA)). 5 Dec 1978. 34p. NTIS, PC A03/MF A01.

Also pub. as Mississippi Univ., University. Research Inst. of Pharmaceutical Sciences Rept. No. RIPS-CIPA-740-L-78.

The distribution and elimination of intravenously administered Methotre-^{14}C (NSC 740) was studied in female, weaning Yorkshire White pigs. After 7 days an average of 33.66% was excreted via the feces and 15.22% via the urine. The fecal elimination percentage was then used to determine the amount of Methotrexate-^{14}C absorbed after topical application. Among the whole organs sampled following intravenous administration, liver, kidney and ovaries had the highest specific activities of radioactivity. Intestine, bone, skin and fat had the highest specific activity levels of the random tissues sampled. An average of 59.99% of a topically applied dose of Methotrexate-^{14}C was absorbed at the end of 7 days. Significant levels of radioactivity were also detected in skin surrounding the site of application.

34393 **(PB—84-163773) Intravenous elimination and percutaneous absorption of topically applied CCNU-^{14}C (NSC-79037) in Yorkshire White pigs. Final report May-Oct 79.** Skierkowski, P.; Murphy, J.C.; Wirth, P.W.; Miller, T.J.; Frick, M.S. (Battelle Toxicology Program Office, Vienna, VA (USA)). 1 Oct 1979. 30p. NTIS, PC A03/MF A01.

Also pub. as Mississippi Univ., University. Research Inst. of Pharmaceutical Sciences Rept. No. RIPS-CIPA-79037-0-79. Sponsored in part by National Cancer Inst., Bethesda, MD.

The distribution and elimination of intravenously administered CCNU-^{14}C (NSC 79037) was studied in female, weanling Yorkshire White pigs. After 7 days an average of 68.18% was excreted via the urine and 2.66% via the feces. The urinary elimination percentage was then used to determine the amount of CCNU-^{14}C absorbed after topical application. Among the whole organs sampled following intravenous administration, kidney, ovary and liver had the highest specific activities of radioactivity. Skin and fat had the highest specific activity levels of the random tissues sampled. 4.78% of a topically applied dose of CCNU-^{14}C was absorbed at the end of 7 days.

34394 **(PB—84-169705) Measurement of ^{15}N in biological samples with particular reference to whole body protein turnover studies.** Preston, T.; East, B.W. (Scottish Universities Research and Reactor Centre, Glasgow (UK)). 1982. 20p. (SURRC—70/82). NTIS, PC E03/MF E03.

This paper describes methods used to analyze total nitrogen and ^{15}N-enrichment of faecal nitrogen, urinary total nitrogen, urea and ammonium and also briefly outlines the procedures adopted to measure whole body protein turnover.

5506 Medicine

REFER ALSO TO CITATION(S) 33841

34395 **(AD-A—137731/6) Radiation survey for installation of the cobalt-60 theratron-80 at Armed Forces Radiobiology Research Institute. Technical report.** Ferlic, K.P. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Dec 1983. 48p. NTIS, PC A03/MF A01.

This report documents the initial radiation survey for installation of the cobalt-60 teletherapy unit in the Standards Lab of the Armed Forces Radiobiology Research Institute. Room modifica-

tions, alarms, and interlocks for this installation are described. Exposure levels as observed for the approved irradiation configurations are provided. Estimated personnel exposures and additional shielding recommendations pro-rated to the maximum authorized source load are made.

34396 **(ARL/TR—059) Quality control procedure for dental x-ray film processing.** Tingey, D.R.C. (Australian Radiation Lab., Melbourne). Aug 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702043.

Methods of obtaining the optimum processing from dental films are discussed. A method of quality control of developing conditions for dental x-ray films has been developed. It is relatively easy to maintain and is sufficiently accurate for practical purposes.

34397 **(GSF-S—708) Organ doses and effective dose equivalent for external neutron beams derived by the CHORD-method.** Wittmann, A.; Burger, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Oct 1980. 110p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751441.

The CHORD-method was applied to the anthropomorphic MIRD-V-phantom, to derive average organ doses for external neutron beams. The phantom was modified by adding suitable breasts, and introducing ovaries. The influence of a more realistic neck on the thyroid doses in comparison with the MIRD-bull-neck was assessed. The depth doses used were those for the total absorbed dose and dose equivalent, including the internally produced gammas, as well as for the neutron component only. The data were taken from ICRP 21 and fitted in the depth interval from zero to 26 cm by suitable analytical expressions. This allowed extrapolation beyond 30 cm phantom depths, as necessary in case of bone density corrections of relevant track length distributions for rays intersecting bone regions. All doses were normalized to the incoming unit neutron fluence, the absorbed doses also to soft tissue KERMA free in air. Based upon the organ dose equivalents, the effective dose equivalent, following ICRP 26, was derived.

34398 **(HRP—0904755/6) Nuclear Magnetic Resonance.** Watkins, D.; Netherton, N. (Central Arkansas Health Systems Agency, Inc., Little Rock (USA)). 26 Nov 1983. 42p. NTIS, PC A03/MF A01.

See also AD-030211.

Nuclear Magnetic Resonance (NMR) is a new technique which has been introduced into the medical diagnostic imaging field. NMR is a method of imaging the body by exposing it to low-energy magnetic and radio-frequency fields. This process yields biochemical information about the part of the body under study. The images can be re-created by computer, and can be used to study moving metabolic systems at work in the body (i.e., watching digestion at work in the stomach).

34399 **(INIS-mf—8327) Testicular tumors - clinical aspects and therapy. Results of the Clinic and Policlinic for Radiotherapy of Wuerzburg.** Hirschmann, K.E. (Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet). 14 Jul 1981. 90p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780309.

In this study the author reports about classification, clinical experience, therapy and therapeutic results of testicular tumors on the basis of results given in literature and of own investigations performed at the Clinic and Policlinic for Radiotherapy at Wuerzburg. In total, 97 patients with testicular tumors were examined and their cases analysed. These patients had received radiotherapy between January 1, 1962 and December 31, 1979. The difficulties with the intended classification of testicular tumors and the advantages and disadvantages of the individual nomenclatures are described. Consideration of the affected age-groups showed that this disease concerns mainly younger males with a high life expectancy. The study depicts the relatively discrete symptoms and signs and the difficulties connected with clinical diagnosis. A more generous indication for the exposition of the testicles is demanded. Also the lymphatic drainage of the testicular region, the resulting paths of metastatic spread and the difficulties connected with the lymphographic detection of metastases are described. There are three therapeutic measures: surgical intervention, radiotherapy and cytostatic treatment. With seminomas mandatory semitestectomy and radiotherapy will suffice; with other affections than seminomas, semitestectomy shall be followed by a combined therapy comprising removal of lymphatic nodes and cytostatic treatment and not so much radiotherapy. The results of treatment given in literature are compared with our results. This comparison revealed good success with treatment of seminomas. With non-seminomal affections exclusive radiotherapy appears to be insufficient. Therefore a combined therapy is postulated, which must be rendered possible by a good interdisciplinary cooperation of pathologists, urologists and radiologists. (orig.).

34400 **(INIS-mf—8328) Alterations of serum potassium, serum magnesium and adenosine diphosphate due to various contrast media containing iodine.** Lehrberger, G. (Marburg Univ. (Germany, F.R.). Fachbereich Humanmedizin). 2 Nov 1979. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780303.

As an introduction of the chemical structure of contrast media is explained. Then follows a survey about the complication rates in examinations with intravascularly applicable iodine-containing contrast media. In the next part clinical symptoms and signs of general and localized contrast media incompatibility reactions, the contrast medium protein reaction and the relationship between allergic reaction and contrast medium are explained. It was tried to attribute the large amount of side-effects to one primary reaction. In this connection the three above-mentioned components were investigated. (orig./MG).

34401 **(INIS-mf—8331) Informative value of radionative diagnostics in cases of patellar chondropathy.** Gloeckler, T.W. (Ulm Univ. (Germany, F.R.). Fakultaet fuer Klinische Medizin). 14 Dec 1979. 25p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780304.

The present study of 64 patients analyzes the diagnostic ability of patellar chondropathy on the basis of X-ray native images. The results were confirmed intraoperatively or arthroscopically. We evaluated images of both knees in a.p. and lateral projection and walking images with 30, 60, and 90° of joint bending. In all cases of chondropathy of third degree, radiomorphologic changes could be delineated; in stage I this was possible in 66% of the cases. The summarizing assessment of structural irregularities as discontinued contours of the subchondral osseous lamella, spot-like or diffuse demineralisation, osteophyteous peripheral serration, disintegration in the insertion area of the quadriceps tendo, soft-tissue swelling and hemarthrosis is significant for establishing the diagnosis. Whereas there is a causal relationship between defective axial positions of the patella or particularly posttraumatic defect and the development of a chrondropathy, we could not detect in the investigated patient-group a significantly higher incidence of chondropathy in cases of dysplasia of the patella or of the femoral condyles. A simple scheme - applicable in arthroscopy and radiology - is introduced: it shall help to record chondromalacious regions and considers the most frequently affected areas. (orig.).

34402 **(INIS-mf—8332) Evaluation of tests of X-ray equipment performed by experts in the hospitals of North Rhine-Westphalia.** Sprenger, D. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1980. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780312.

Tests of X-ray equipment by experts, which are required by paragraph 4, chapter 1 RoeV (X-ray Regulation), are considered as a effective measure for reducing exposure to irradiation during the application of X-rays for medicinal purpose. As soon as well detected deficiencies will be cleared out, a reduction of gonad exposure for patients and applicants by approx. 50% is expected to result. However, by December 31, 1978 14.8% of all tested X-ray systems had not achieved the experts' approval. (DG).

34403 **(INIS-mf—8338) Computer-aided radiometric densitometry.** Dahlmann, H. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 13 - Elektrotechnik 1). 12 Feb 1982. 149p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780314.

Densitometry by the Cs-137 γ-radiation principle has an extensively autonomous calibration of the measured length and an automatic adjustment of measuring time. A time constant switch is provided, and the influence of modules on measuring accuracy has been largely eliminated by diagnostic programs. The modular structure makes it feasible to provide a self monitoring of nearly all system components by means of the microcomputer without additional expenditure. The logarithmical dependency of impulse rate and density can be linearised by the microcomputer. The attenuation of intensity of the material caused by the radioactive decay is compensated. (DG).

34404 **(INIS-mf—8355) Clinic, diagnosis and therapy of tumors of the small intestine. A survey about 53 cases between 1961 and 1980.** Alberty, M.A.F. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1981. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780305.

53 cases of tumor of the small intestine were observed, of which 23 were benign, 14 carcinomas, 10 sarcomas, 6 carcinoid tumors. The age ranged from 1 to 81 years; an incidence peak was found between 51 and 60. The ratio of male and female patients was 3 : 2. Almost all patients with a malignancy came to our hospital with an already advanced stage, 65% of the malignant tumors had already developed metastases. Preoperative diagnostics was significantly improved during the last years. Since 1972, i.e. since hypotonous duodenography, double contrast technique and endoscopy are applied, accuracy of the diagnostic methods could be increased by more than 100%. But due to the fact that these improved techniques were applied too late because of atypical symptoms and signs, prognosis of malignomas of the small intestine has been bad also in the last years. 16% of the patients died of postoperative complications and the 5-year survival rate was only 18%. From this results that prognosis cannot be improved even by applying the modern diagnostic methods, because malignant tumors of the small intestine provoke pain almost exclusively in advanced stages. There don't exist typical early symptoms or signs. (orig./ARB).

34405 **(INIS-mf—8358) Results of radiotherapy of malignant tumors of the epi-, meso- and hypopharynx. A retrospective study from 1960 to 1978.** Gehrcke, M. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 5 Aug 1980. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780310.

It is reported about the treatment results of 256 patients who suffered from a malign pharyngeal tumor and were irradiated with Gammatron and/or Betatron (19 MeV). The intended dosage for tumors was 6000 rd, for the usually also radiated cervical lymphatic passages 5000 rd. Radiotherapy was performed over 6 weeks in single fractions of 200 to 250 rd. All three pharyngeal regions together present a 3-year-survival rate of 28% and a 5-year-survival rate of 17%. Those patients who received surgical intervention and radiotherapy reached a 3-year-survival rate of 36% and a 5-year-survival rate of 22%, the exclusively irradiated patients achieved rates of 26% and 16%. In about the half of all malignant cases relapses and/or metastases developed within two years after therapeutic treatment had been finished. Today 40 of the 245 patients who were followed up live without any symptoms or signs. The best symptom-free survival time is 19 years. (orig./MG).

34406 **(INIS-mf—8359) Comparison of CT and angiographic findings about tumors of the posterior cranial fossa.** Lohmann, I. (Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet). 23 Feb 1981. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780306.

The CT and angiographic criteria of localisation and classification of tumors of the posterior cranial fossa are explained on the basis of 44 histologically verified cases. (orig.).

34407 (INIS-mf—8695, pp 58) **Combined method for morphological and functional roentgenologic study of the operated stomach by double contrast and "food cocktail".** Delov, I.; Sirakova, A.; Simov, S. 1983. (In Bulgarian). NTIS (US Sales Only), PC A07/MF A01. Order Number TI84780122. (CONF-8306167—Absts.).

From 4. scientific practical conference of the roentgenologists, radiologists and radiobiologists from North Bulgaria; Gabrovo, Buulgaria (4 Jun 1983).

Published in summary form only.

34408 (INIS-mf—8695, pp 103) **Left ventriculography in physical loading conditions on gamma camera nuclear ohaio sigma 410.** Shejpetova, E.; Trindev, P.; Ivanov, Zh. (Meditsinska Akademiya, Sofia (Bulgaria). Nauchen Inst. po Rentgenologiya i Radiobiologiya). 1983. (In Bulgarian). NTIS (US Sales Only), PC A07/MF A01. Order Number TI84780122. (CONF-8306167—Absts.).

From 4. scientific practical conference of the roentgenologists, radiologists and radiobiologists from North Bulgaria; Gabrovo, Buulgaria (4 Jun 1983).

Published in summary form only.

34409 (INIS-mf—8695, pp 94) **Beta therapy for conjunctivitis vernalis.** Iliev, E.; Chilova Atanasova, B. 1983. (In Bulgarian). NTIS (US Sales Only), PC A07/MF A01. Order Number TI84780122. (CONF-8306167—Absts.).

From 4. scientific practical conference of the roentgenologists, radiologists and radiobiologists from North Bulgaria; Gabrovo, Buulgaria (4 Jun 1983).

Published in summary form only.

34410 **(INIS-mf—8709) Extracorporeal radiotherapy of blood using conventional radiation sources for treatment of CLL.** Oehl, N. (Ulm Univ. (Germany, F.R.). Fakultaet fuer Theoretische Medizin). 19 Dec 1980. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780252.

A comparison of extracorporeal irradiation of blood (ECIB) with other forms of therapy for treatment of CLL reveals that ECIB has considerably fewer side-effects. This justifies its application in the early stages of illness. Intermittent ECIR treatment over a period of months enables a partial remission attained following initial intensive treatment to be upheld without serious complications. ECIB treatment also appears useful in chemo-resistant cases, since chemotherapy has been reported to be successful in a number of cases directly following ECIB therapy. ECIB therapeutic trials for pregnant patients is highly recommended. Although no negative effects of ECIB have to date been observed on the normal blood cell physiology it is nevertheless possible that intact strains are destroyed and thus further adversely affect the already injured normal blood cell status. The question as to how far ECIB, in treating special cases of CLL, may cause an increase in proliferation rate of lymphatic cells, ultimately remains unclarified. Further studies on possible feedback mechanisms are essential. Should these reveal that a recruitment of pathological cells is influenced by stimulation then ECIB treatment combined chemotherapy would show promise in phases of increased cell division. (orig./MG).

34411 **(INIS-mf—8711) Normal anatomy and pathological changes of the infrapatellar pad of fat in double contrast arthrography.** Boehnke, E. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1980. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780249.

The diagnostic validity of double-contrast angiography in patients with Hoffa's disease was studied by re-evaluation of 1566 arthrographs without knowing the surgical findings. In order to obtain more information on the anatomy and pathology of the intrapatellar pad of fat, so knee joints of corpses were dissected who had died at different stages of life. As the studies showed, the decisive diagnostic factors in Hoffa's disease are the clinical complaints and an enlarged pad of fat in the arthrographic picture. (orig.).

34412 **(INIS-mf—8716) German radiological congress 1983. Author's abstracts.** Haubitz, B.; Stender, H.S. (comps.). (Deutsche Roentgengesellschaft, Gesellschaft fuer Medizinische Radiologie, Strahlenbiologie und Nuklearmedizin e.V., Hamburg (Germany, F.R.)). 1983. 383p. (In German). (CONF-8306178—Absts.). NTIS (US Sales Only), PC AXX/MF A01. Order Number DE84780248.

From German radiological congress; Hanover, F.R. Germany (16 Jun 1983).

The publication contains the abstracts of the 261 papers read at the meeting and the 82 further papers announced, and 37 brief descriptions of the contributions to the scientific exhibition. The papers were on the subjects of radiology, nuclear medicine and to a certain extent, also radiobiology. (MG).

34413 (INIS-mf—8721) **Results of primary and postoperative radiotherapy of malignant tumours of the larynx and posterior pharynx.** Poppele, G. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1980. 156p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780253.

In a study on the epidemiology of laryngeal and pharyngeal tumours, a coincidence was found between established alcohol abuse and tumours of the two organs. The results of surgery followed by gammatron radiotherapy (laryngeal tumours) or betatron therapy (pharyngeal tumours) are prescuted and discussed. (APR).

34414 (INIS-mf—8722) **Axial CT of the brain compared with other clinical methods of examination in neuropaediatry.** Miller, E. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Medizin). 12 Jul 1979. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780250.

CT of the neurocranium and EEC were carried out in 53 children aged 10 weeks to 15.5 years. In most of the children, also plain-film X-rays of the skull, echoencephalography, scintiscans of the brain, cerebral angiography and, in a few cases, pneumoencephalography were carried out. The methods of examination were comparatively evaluated for neoplastic, inflammatory, congenital and degenerative diseases and cerebral attacks. (APR).

34415 (INIS-mf—8902) **Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear Medicine.** Sailer, S. (Graz Univ. (Austria). Medizinische Klinik); Thumb, N. (Krankenhaus Baden (Austria). Interne Abt.); Mostbeck, A. (Wilhelminenspital, Vienna (Austria). Nuklearmedizinisches Inst.). (Oesterreichische Gesellschaft fuer Innere Medizin, Vienna). 1983. 98p. (In German). (CONF-8309215—Absts.). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780308.

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

The proceedings contain the abstracts of the presentation in German language. Only some of them pertain to the subject scope of INIS. (A.N.).

34416 (INIS-mf—8902, pp 1) **Dynamic joint scintigraphy in diagnosis of rheumatic diseases.** Atefie, K.; Ammer, K. (Ambulatorium Sued, Vienna (Austria). Nuklearmedizinisches Institut). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34417 (INIS-mf—8902, pp 5) **Use of computer tomography for diagnosis of sacroiliitis.** Ellegast, H.H.; Irnberger, Th.; Petershofer, H.; Prohaska, E. (Landeskrankenanstalten Salzburg (Austria)). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34418 (INIS-mf—8902, pp 27) **New nuclear medical method for testing the function of the left ventricle.** Brugger, P.; Klein, G. (Ludwig Boltzmann-Institut fuer Rehabilitation, Saalfelden (Austria)). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34419 (INIS-mf—8902, pp 29) **Relations between thallium-201-scintigraphy and function of the left ventricle.** Schmoliner, R.; Dudczak, R.; Kronik, G.; Homan, R.; Moesslacher, H.; Frischauf, H. (Vienna Univ. (Austria). 1. Medizinische Klinik). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34420 (INIS-mf—8902, pp 80) **Use of myocardscintigraphy with 99M-Tc-pyrophosphate at dilatative cardiomyopathy.** Blazek, G.; Kainz, W.; Poradek, Th.; Kahn, P. (Hanuschkrankenhaus, Vienna (Austria). 2. Medizinische Abt.). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34421 (INIS-mf—8902, pp 72) **Thyroid gland carcinomas after therapy with iodine-131.** Galvan, G. (Landeskrankenanstalten Salzburg (Austria). Inst. fuer Nuklearmedizin und Endokrinologie). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34422 (INIS-mf—8903, pp 209-210) **^{131}I scan of cold masses in ectopic thyroid tissue using a rectilinear scanner.** Gordin, M.; Chisin, R.; Atlan, H. (Hebrew Univ., Jerusalem (Israel). Hadassah Medical School). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34423 (INIS-mf—8903, pp 211-213) **Noninvasive diagnosis of right ventricular infarction.** Garty, I.; Barzily, J. (Central Emek Hospital, Afula (Israel)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34424 (INIS-mf—8903, pp 214-215) **Scintillographic visualization of inborn gallbladder duality.** Czerniak, A.; Czerniak.P.: Shoham, J. (Czerniak Nuclear Medicine Institute, Tel Aviv (Israel)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

Published in summary form only.

34425 (INIS-mf—8903, pp 224-226) **Radionuclide study in post-trauma splenectomy cases.** Zwas, S.T.; Samra, D.; Samra, Y. (Sheba Medical Center, Tel Hashomer (Israel); Tel Aviv Univ. (Israel). Medical School). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34426 (INIS-mf—8903, pp 187-189) **sup(195m)Au a short-lived nuclide suitable for vascular imaging. Development of a new mercury-195m → gold-195m generator.** Guillaume, M.; Brihaye, C. (Liege Univ. (Belgium). Lab. des Isotopes); Lavi, N. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34427 **(PB—84-164037) Radioprotective capacity of phenylalanyl-cysteamine derivatives on cells in vitro.** Vos, O.; de Borst, C. (Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab. TNO). 1982. 23p. (In Dutch). (MBL—1982-15). NTIS, PC E03/MF E01.

Also pub. as Prins Maurits Lab. TNO, Rijswijk (Netherlands) Rept. No. PML-1982-53.

The radioprotective capacity of some phenylalanyl-cysteamine derivatives was tested in mice and on cells in vitro. It was observed that phenylalanyl cysteamine provided some protection. Introduction of an acetyl group did not improve the protective capacity.

34428 **Portrayal of pheochromocytoma and normal human adrenal medulla by m-[^{123}I]iodobenzylguanidine: concise communication.** Lynn, M.D.; Shapiro, B.; Sisson, J.C.; Swanson, D.P.; Mangner, T.J.; Wieland, D.M.; Meyers, L.J.; Glowniak, J.V.; Beierwaltes, W.H. (Univ. of Michigan, Ann Arbor). *Journal of Nuclear Medicine;* **25**: No. 4, 436-440(Apr 1984). Contract AC02-76EV02031.

The radiopharmaceutical m-[^{131}I]iodobenzylguanidine (I-131 MIBG), which is readily taken up by adrenergic vesicles, produces scintigraphic images of pheochromocytomas in man but rarely visualizes normal adrenal glands. Iodine-123 has many potential advantages over I-131 as a radiolabel for MIBG, including shorter half-life, freedom from beta emissions, and increased gamma-camera efficiency. In this study, diagnostic doses of MIBG labeled with I-131 and I-123, with nearly equivalent radiation dosimetry, were compared as imaging agents in eight patients with known or suspected pheochromocytoma. Images of superior quality were obtained with I-123 MIBG. In addition, the normal adrenal medullae were visualized on the I-123 MIBG scintigrams in six out of eight patients.

34429 **A design study of the neutron irradiation facility for boron neutron capture therapy.** Oka, Y.; An, S.; Yanagisawa, I. (The University of Tokyo Nuclear Engineering Research Laboratory The Faculty of Engineering, Tokai-mura, Ibaraki 319-11). *Nuclear Technology;* **55**: No. 3, 642-655(Dec 1983).

A design study of the neutron irradiation facility for boron neutron capture therapy was performed using two-dimensional transport calculations. Dose depth distributions in a phantom head were calculated for various neutron energies. The epithermal neutrons having the energies between 10 eV and 0.5 keV are suitable for the therapy. To obtain the epithermal neutron beam, the neutrons leaking downward through the central hole of the annular core TRIGA reactor were moderated through a mixture of heavy water with aluminum whose volume ratio is 15:85. Bismuth and lithium fluoride tile was used to remove gamma rays and thermal neutrons from the beam. Iron, borated polyethylene, and lead were used as the shield surrounding the moderation layer. When the epithermal neutron column is used, the maximum usable depth and irradiation time are 6.9 cm and 7.25 h, respectively, at a 2-MW level.

5507 Microbiology

REFER ALSO TO CITATION(S) 32788, 32798, 32799, 32800, 32801, 32802, 34388

34430 **(BNL—34783) Effect of chromosome homology an plasmid transformation and plasmid conjugal transfer in Haemophilus influenzae.** Balganesh, M.; Setlow, J.K. (Brookhaven National Lab., Upton, NY (USA)). 14 May 1984. Contract AC02-76CH00016. 25p. (CONF-8405187—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012898.

From Plasmids in bacteria research conference; Urbana, IL, USA (14 May 1984).

The pairing between plasmid and the homologous part of the chromosome associated with plasmid establishment may differ from the pairing which results from integration of a homologous region of the plasmid into the chromosome. Thus the rate of novobiocin transformation decreases with duplication of the chromosomal portion in pMB2, but the rate of establishment of the plasmid increases with this duplication. A model to explain these data is given. 17 references, 5 figures, 4 tables.

34431 **(LA-UR—84-1796) Rapid microbial identification by circular intensity differential scattering.** Gregg, C.T.; Salzman, G.C. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 28p. (CONF-8406148—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013894.

From 4. international symposium on rapid methods and automation in microbiology; Berlin, F.R. Germany (7 Jun 1984).

Circular Intensity Differential Scattering (CIDS) is one of the few really new approaches to microbial identification to have come into existence in the past several decades. The CIDS spectra can be measured as a function of wavelength, scattering angle, and/or matrix element, and a number of matrix elements can be measured virtually simultaneously. This panoply of measurements potentially gives the method resolving power for microbial identification. Some representative data taken over the past couple of years on CIDS spectra of several anti-viral vaccines is presented. 17 references; 9 figures.

34432 **(STF—21A82101) Final administrative report, the BIOSIS-project/. Canada 1980-1982.** Sendstad, E. (SINTEF, Trondheim (Norway)). Dec 1982. 115p. (In Norwegian,English). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751020.

Includes as appendixes two working reports on the biodegradation of oil.

The microbal degradation of oil on shore is studied. The natural occurrence of oil degrading microorganisms on an arctic shore was investigated. The types and their mineralization capacity were determined. The shoreline sand and sediment contained low but detectable numbers of oil degrading microorganisms. A large increase in oil degrading bacteria could be registered during a week after spraying with weathered Lago Medio crude oil or the same oil as 50 % water-oil emulsion. Part of the microbal activity in the oil film can be increased about five times adding macro nutrients. The availability of macro nutrients more than the access to oxygen limited the oil degradation on the shores in question. Experiments with BP solidifying agent showed increase in heterotrophic activity compared to untreated oil film. It was also possible manually to remove about 50 % of the oil from the sandy and gravel covered beach. Mechanical mixing of oil sediments and the use of bark as an absorbing agent did not enhance the natural decomposition. 22 figures, 35 tables.

34433 (STF—21A82101, pp 48) **Microbiology: II. Biodegradation of oil - 1980 study results.** Eimhjellen, K.; Sommer, T.; Sendstad, E. 1981. NTIS (US Sales Only), PC A03/MF A01. Order Number TI84751020. (BIOS/WR—80-6).

Bound as an appendix to the Norwegian final administrative report for the project.

In Final administrative report,The BIOSIS-project/. Canada 1980-1982.

During autumn 1980 analyses of baseline parameters related to microbial degradation of oil were determined from the nearshore waters, sediments of a channel, in shoreline sand, sediments inside and outside a lagoon in the Cape Hatt area. Most probable number techniques were used to assess counts of oil/degrading microorganisms(bacteria), generally heterotrophic bacteria and antibiotica resistant oil/degrading microorganisms (fungi). An experimental laboratory technique was used to determine rates of mineralization of generally tritiated Lago Medio crude oil and ^{14}C-labelled n-hexadecane, naphthalene and benzopyrene. As a measure of general biological activity in shoreline sand and sediments a field method for determining CO_2-production were used. In the coastal water an average content of $4x10^4L^{-1}$ oil, degrading bacteria was detected, representing about 1% of the assessed viable count for generally heterotrophic bacteria. Experiments with tritiated Lago Medio crude oil yielded maximum rates (V/sub max/) of mineralization of oil by the microorganisms in water. Tentative results indicated a somewhat lower activity for mineralization of n-hexadecane. The shoreline sand and sediment contained low but detectable numbers of oil degrading microorganisms. After spraying with weathered Lago Medio crude oil or the same oil as a 50% water-oil emulsion an increase in oil/degrading bacteria from about 10^2 to 10^5 respectively 10^7 cells per ml sand/oil mixture could be registered over a period of 15 days. 4 figures, 15 tables.

34434 **Microbial degradation of dissolved proteins in seawater.** Hollibaugh, J.T.; Azam, F. (Univ. of California, San Diego). *Limnology and Oceanography;* **28**: No. 6, 1104-1116(Nov 1983). Contract AM03-76SF00010.

An experimental protocol using radiolabeled proteins was developed to investigate the rates and mechanisms whereby dissolved proteins are degraded in natural marine plankton communities. The results of field observations and laboratory experiments indicate that proteins are degraded by a particle-bound, thermolabile system, presumably bacteria-associated enzymes, with an apparent half-saturation constant of ca. 25 μg bovine serum albumin (BSA) per liter. Gel permeation chromatography indicated that peptides of chain length intermediate between BSA and the final products of degradation (MW<700) do not accumulate in the medium. Competition experiments indicate that the system is relatively nonspecific. Turnover rates for the protein pool in samples collected in the Southern California Bight were of the same order of magnitude as the turnover rate of the L-leucine pool and were correlated with primary productivity, chlorophyll a concentrations, bacterial abundance and biomass, and L-leucine turnover rate. These data suggest that amino acids derived from proteins are utilized preferentially and do not completely mix with the amino acids in the bulk phase.

5508 Morphology

34435 **(INIS-mf—8710) RNA synthesis of perinatal female and male gametes. Autoradiographic studies in Wistar rats.** Doering, R.; Hubaleck, K. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1980. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780244.

Intensity curves of RNA synthesis in the perinatal phase of gametogenesis were established for rat fetuses and young rats by ^3H-uridine autoradiography. Gonads of male and female rat fetuses were studied on days 15 to 22 p.c. and gonads of young animals on days 1 to 7 p.n. The nuclear surface of the gametes was found to increase continuously. The number of silver grains was the same for male and female gametes up to the 18th day of fetal life, and the same applies to the silver grain density. The rate of RNA synthesis of male germ celles remained at a constant, low level throughout the study; in the female germ cells, a 10-fold increase in RNA synthesis was measured after the 19th day of fetal life. (orig./MG).

34436 **(INIS-mf—8744) Radio in-vitro thyroid studies in newborn and children up to 14 years of age in consideration of present diseases.** Friese, M.E.; Jung, K. (Giessen Univ. (Germany, F.R.). Fachbereich Humanmedizin). 1981. 144p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780348.

In 630 children from newborn age to 14 years, T_3, T_4, T_3 uptake, reverse T_3 (RT_3) and TSH were determined by nuclear methods, and the overall balance of the free iodine hormone indices and the quotients T_4:T_3, RT_3:T_4 and RT_3:T_3 were calculated on this basis. There was a typical modification with age of these parameters which was most pronounced during the first 24 months of age. Induced by TSH secretion, which is very high in the postpartum stage and then decreases continuously, the primarily subnormal T_4 level increases by 60% in the first month of age and then goes back to normal after two months. The RT_3 levels changed inversely. The T_3 uptake increased to constant, normal levels within a 4-week period while the overall balance of the free iodine hormone indices reaches its peak after 4 weeks and the goes back to normal. Diseases cause characteristic changes in the hormone pattern. The central role of the liver in the peripheral conversion of T_4 to T_3 or RT_3 was confirmed. The increasing RT_3 level, which is correlated with a decreasing T_3 level, is a significant factor in many diseases; it is also a suitable parameter for screening newborns for hypothyreosis. (orig./MG).

5509 Pathology

REFER ALSO TO CITATION(S) 33795, 34431, 34436

34437 **(INIS-mf—8707) Radioimmunoassay of dehydroepiandrosterone and androstenedione in women with hirsutism.** Bieser, L.U. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1979. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780251.

Dehydroepiandrosterone (DHEA) and androstenedione (A) concentrations in peripheral plasma were determined by RIA in 278 hirsute women. Plasma concentrations of DHEA and A were related to the clinical symptoms of ovarial, adrenal and idiopathic hirsutism. The mean DHEA and A concentrations were measured in 69 patients after treatment with cypoterone acetate and ethynyl estradiol. Findings are reported and discussed. (APR).

34438 (INIS-mf—8902, pp 74) **Determination of FT4-fraction by the help of a monoclonal T4 antibody.** Koehn, H. (Wilhelminenspital, Vienna (Austria). Nuklearmedizinisches Inst.). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34439 (INIS-mf—8902, pp 75) **One year experience with FT4 screening.** Kahn, P.; Tham, B. (Hanuschkrankenhaus, Vienna (Austria). Nuklearmedizinisches Inst.). 1983. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780308. (CONF-8309215—Absts.).

From Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M; Salzburg, Austria (22 Sep 1983).

Published in summary form only.

34440 **(LBL—17826) Characterization of biophysical properties of baboon lipoproteins: modulation by dietary fat and cholesterol.** Babiak, J. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84013401.

Portions are illegible in microfiche products; Thesis.

The serum lipoproteins of baboons fed diets containing differing types and amounts of fat and varying amounts of cholesterol were examined by analytic ultracentrifugation, gradient gel electrophoresis, density gradient ultracentrifugation, sodium dodecyl sulfate-polyacrylamide electrophoresis, electron microscopy, and standard protein and lipid composition assays. These studies characterized the lipoproteins of the baboon, observed how concentrations and physical-chemical properties of the lipoproteins are modulated by dietary fat and cholesterol and described the suitability of the baboon as an animal model of human lipoprotein metabolism. Results indicate that baboon high density lipoproteins (HDL), though higher in total serum concentration than human HDL, are

remarkably similar to human HDL. The concentration of baboon HDL is increased by dietary saturated fat but decreased by the addition of cholesterol. While serum concentrations of low density lipoproteins (LDL) tend to be lower in baboons, the physical-chemical properties of the LDL of baboons and humans are comparable. The LDL of both species contains apolipoprotein B as their major apolipoprotein and exhibit considerable polydispersity in particle size. LDL of both species consists of seven discrete subpopulations. The analytical and statistical data presented in this dissertation indicate that the baboon is a good model for studying the role of lipoproteins in the development of atherosclerosis. 125 references, 31 figures, 28 tables.

5510 Physiological Systems

34441 **(INIS-mf—8743) Statistical comparative study on a combined radioiodine test and extended protirelin test and correlation with the common in vitro parameters of thyroid function.** Kraemer, H.A. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780347.

Using the data of 339 patients, the following parameters of thyroid function were statistically evaluated. The in vitro parameters ET_3U, $TT_4(D)$, FT_4-index and $PB^{127}I$ and the radioiodine test with determination of $PB^{131}I$ before i.v. injection of 400 μg protirelin (DHP) and 120 minutes after the injection. There was no correlation between the percent change of the $PB^{121}I$ level 120 min after protirelin (DHP) administration and the percentage change of the TSH level 30 min after protirelin (DTP1) administration. The accuracies of the in vitro parameters ET_3U, $TT_4(D)$ and FT_4-index on the one hand and the extended protirelin test on the other hand were compared. (orig./MG).

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 34334, 34484

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 34387

34442 **(AD-A—137543/5) Initial human response to nuclear radiation. Technical report.** Anno, G.H.; Brode, H.L.; Washton-Brown, R. (Pacific Sierra Research Corp., Santa Monica, CA (USA)). 1 Apr 1982. 92p. NTIS, PC A05/MF A01.

This report documents the results of the first phase of an investigation into the nuclear effects on military troop performance. Both signs and symptoms associated with radiation sickness were examined to develop models of human response to radiation as a function of dose, time and symptom severity. Data on the early symptomatic effects of radiation exposure were gathered from some 150 books, articles and monographs. The analysis of this data focused on human data collected from the victims of nuclear accidents and therapy patients. Data from the survivors of the Japanese atomic bombs were excluded because of data imprecision and questions raised about the accuracy of reported exposure levels. A hypothetical exposed population was divided of reported groups based on the sensitivity of individuals to radiation: hyper-, hypo-, and normsensitives. The population was also classified by the severity of their symptoms; unaffected and mildly, moderately and severely affected. Using this data, relationships for the onset time and duration of acute symptoms after a given radiation dose were developed. Conceptual models were then derived for (1) individual response as a function of dose, time after exposure, and severity of symptoms, (2) population response (percentage affected in various degrees), and (3) links between individual and population responses.

34443 **(AD-A—137718/3) AFRRI (Armed Forces Radiobiology Research Institute) annual research report 1 October 1980-30 September 1981.** (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 30 Sep 1981. 125p. (AFRRI-ARR—15). NTIS, PC A06/MF A01.

This report contains a summary of the research projects of the Armed Forces Radiobiology Research Institute for the period 1 October 1980 through 30 September 1981.

34444 **(EUR—8486) Radiation protection programme: Progress report 1982.** (Commission of the European Communities, Luxembourg). 1982. 1236p. NTIS, PC E20/MF E20.

The 1982 progress report of the radiation protection program contains summaries of reports on research projects under six headings: (1) radiation dosimetry and its interpretation (48 projects), (2) behavior and control of radionuclides in the environment (53 projects), (3) short-term somatic effects of ionizing radiation (44 projects), (4) late somatic effects of ionizing radiation (58 projects), (5) genetic effects of ionizing radiation (82 projects), and (6) evaluation of radiation risks (45 projects). Each report gives details of the contractor, the head of the research team, the general subject of the contract, and the list of projects involved.

34445 **(GSF-S—960) Radiation dose to the thyroid due to incorporation of iodine isotopes: Age dependence and reliability of dose factors.** Henrichs, K.; Mueller-Brunecker, G.; Paretzke, H.G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Aug 1983. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751502.

This is the first time that dose factors are published in the literature, together with an assessment of their reliability with regard to the quantification of the dose received by the population in the Federal Republic of Germany due to incorporation if iodine isotopes, taking into account the given age distribution among the population. The calculation of dose factors is based on the latest dosimetric and metabolic models issued by the ICRP (ICRP-30), and the impact of the various parameters and their variability on the accuracy of dose factor determination is assessed. The procedure followed to calculate the dose due to incorporation on the basis of metabolic models (ICRP 1978 and ICRP 1979) is explained. The main data (such as half life, mean frequency per decay, mean energy in keV) are given for I-123, I-125, I-129, I-131, I-132, I-133, I-134, and I-135 (ICRP-30) and listed in tables.

34446 **(INIS-mf—8384) Radioisotope studies for quantitative measurement of manganese absorption.** Helbig, U. (Technische Univ. Muenchen, Freising (Germany, F.R.). Fakultaet fuer Landwirtschaft und Gartenbau). 30 Jun 1981. 142p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780243.

Purpose of the present study was to quantitatively determine the manganese absorption in growing rats by means of radioisotopes. First of all the following factors had to be investigated, which are significant for this determination: Measurability of stable and radioactive Mn in rat tissues; labelling of stable Mn and distribution of stable and radioactive Mn in the organism; verification of the isotope dilution method and of the comparative balance method with regard to its applicability for the determination of the true Mn absorption. We used male and female Sprague-Dawley rats. The most important results are summarized in the following: in some separate tissues measurement of stable Mn was accompanied by difficulties. The measurement of radioactive Mn however, could be performed without any problems. 10 d after i.m. injection of ^{54}Mn only 17% of the administered Mn was still detectable in the organism. However, there was no uniform tissue labelling found. Therefore it is possible to an only restricted extent to draw quantitative conclusions on the content of stable Mn. A high percentage of stable and radioactive Mn was found above all in the liver. The isotope dilution method permits by feces analysis to differentiate between unabsorbed Mn coming from the food and endogenic Mn coming from the organism itself. The effective Mn absorption was also determined by means of the comparative balance method. By means of the isotope dilution method we determined the quantita-

tive Mn-absorption with staged Mn administration and the contribution of absorption and excretion to the homeostatic regulation mechanisms of Mn. We found that absorption and excretion help the organism to keep an almost constant Mn concentration even with a differing Mn supply. (orig./MG).

34447 (INIS-mf—8695, pp 133) **Genetic risk from irradiation of the Bulgarian population for medical purposes.** Bajrakova, A.; Vasilev, G. (Meditsinska Akademiya, Sofia (Bulgaria). Nauchen Inst. po Rentgenologiya i Radiobiologiya). 1983. (In Bulgarian). NTIS (US Sales Only), PC A07/MF A01. Order Number TI84780122. (CONF-8306167—Absts.).

From 4. scientific practical conference of the roentgenologists, radiologists and radiobiologists from North Bulgaria; Gabrovo, Buulgaria (4 Jun 1983).

Published in summary form only.

34448 (INIS-mf—8706) **Relationship between radiation load and chromosome aberrations in permanent staff of nuclear facilities.** Heubisch, W. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 14 Jan 1982. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780246.

Employees of nuclear power stations can be exposed to an increased risk. Using chromosome analytical methods an attempt is made to establish a dose-response relationship for relatively low radiation dose levels. Chromosome aberrations in lymphocytes at the stage of mitosis were classified according to morphological structure and gaps. Correlation and regression analysis produced a positive relationship compared to the previous year's dose and aberrations, whereas no dependence could be proved for the actual age dose and age. (DG).

34449 (INIS-mf—8712) **Determination of organ doses during radiological examinations and calculation of somatically significant dose.** Steiner, H. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1980. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780247.

Examples are used to demonstrate that a shift in the point of emphasis is necessary with regard to radiation hazard in medicinal X-ray diagnosis. The parameters employed in this study to calculate somatic dose (SD) and somatically significant dose (SSD) may well be in need of modification; nevertheless the numerical estimation of SSD arrived at here appears to reflect the right order of magnitude for the estimation of somatic risk. The consideration of the threshold dose for somatic injury remains a problem. (orig./MG).

34450 (INIS-mf—8903, pp 157-164) **Increased DNA repair capacity by WR-2721 following gamma accelerated electrons UV and neutron radiation.** Riklis, E.; Hagan, M.P.; Freschi, J.E.; Catravas, G.N. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34451 (INIS-mf—8903, pp 166-169) **Improved radioprotection of cells afforded by activated radioprotective compounds WR-2721 and MPG.** Green, M.; Riklis, E. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34452 (INIS-mf—8903, pp 170-172) **Degree of correlation between cancer proneness, metastaic potential, and DNA repair capacity.** Riklis, E.; Fidler, I.J.; Hart, I.; Gruys, E.; Kripke, M.L. (National Cancer Inst., Bethesda, MD (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34453 (INIS-mf—8903, pp 216-221) **Effect of the addition of unirradiated autologous monocytes on the thymidine uptakes of PHA stimulated γ irradiated OKT4+, OKT8+ and peripheral blood lymphocytes.** Manori, I.; Kushelevsky, A. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Nuclear Engineering); Weinstein, Y.; Segal, S. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Soroka Medical School); Van Wauwe, J. (Janssen Pharmaceutica (Belgium)). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34454 (INIS-mf—8903, pp 195-198) **Experimental evaluation of photoneutron doses and photoneutron spectrum from A 16 MeV X-ray medical linear accelerator using CR-39 and polycarbonate passive detectors.** Faermann, S.; Eisen, Y.; Ovadia, E.; Schlesinger, T. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Werner, A.; Zhigun, L. (Sheba Medical Center, Tel Hashomer (Israel)); Kushilevski, A. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Nuclear Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34455 (INIS-mf—8943) **Effect of ionizing radiation with different ionizing density on the uni-cellular Alga Micrasterias denticulate Breb.** Reubel, B. (Salzburg Univ. (Austria)). 1982. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780342.

The uni-cellular green alga Micrasterias denticulata Breb is very suitable for cytological, ultrastructural investigations as well as for growth studies of cell populations because of its size and its specific cellular pattern. Therefore these cells were investigated for their cell-cycle-dependent reaction to different types of radiation, dose-rates and cumulated doses and compared with results from the literature on radiobiological effects on single cells. Different types of ionizing radiation were used such as gamma rays (^{60}Co, ^{241}Am), alpha rays (^{241}Am) neutrons (^{252}Cf and 14 MeV-neutrons from a particle-accelerator) and protons (20-MeV-protons from a particle-accelerator). Irradiation with low doses (gamma-, neutron irradiation) did not show any statistically significant results. No effects could be observed after alpha irradiation because of the alpha particles could not penetrate the mucus cover. Irradiation with gamma rays and protons showed statistically significant reversible and irreversible effects. The reversible effect appeared in a dose-dependent division-delay of the populations. The results from literature, cell-cycle observations and ultra-structural investigations point to a block in the G_2-phase and prolongation of the S-phase. Irreversible irradiation damage is caused by neutron- and proton irradiation. In the first case the length of division delay shows no dose-dependence. In the second case the following cell-cycles are retarded. The dose-effect-curves of proton-irradiations with different dose-rates show a plateau at high doses, which seems to be effected by the turn-on of an additional repair-mechanism. (Author).

34456 (INIS-mf—8947) **Investigations on the influence of radiation with variable linear energy transfer (LET) on the DNA-content and DNA-repair-mechanisms in Vicia faba.** Eckl, P. (Salzburg Univ. (Austria)). 1981. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780343.

This study was initiated to investigate, whether there are any radiation-induced changes in DNA-content and if these changes can be repaired. Seeds of Vicia faba L. were grown in glass culture vessels. After 10 to 20 days the seedings were irradiated using a 1 Ci ^{60}Co gammasource (90mrad/h and 33 rad/h) and a 5 mCi ^{252}Cf neutron source (90 mrad/h). Both, neutron and gamma irradiation cause a reduction in nuclear DNA-content even after low doses (1 to 10 rad). The extent of depression depends only on linear energy transfer. Parallel to the induced minimum in DNA-content, but shifted to higher doses, also the mitotic activity reaches a minimum. Whereas neutron irradiation results in a total stop after doses of 8

rad, gamma-irradiation only induces a depression of 80 %. Whith higher doses the mitotic activity increases again. The neutron-induced changes in DNA-content seem to be restored within 90 minutes after irradiation. No continuous increase could be found after low gamma-doses. Gamma-irradiation with higher dose rates (^{60}Co, 33 rad/h) causes a general decrease over the dose-range studied (100 to 1600 rad). Following doses of 100 rad the mitotic activity increases significantly. With higher doses the decrease is exponential. A dose-dependent mitotic delay could also be observed. As described by many authors, unscheduled DNA-synthesis (UDS) could not be detected in nuclei of Vicia faba. This indicates that an other system, perhaps acting in situ - at the damaged place - is responsible for the repair of radiation-induced thymine-damages. (Author).

34457 **(Juel—1868) Chemical and biological consequences of the radioactive decay of iodine-125 in plasmid DNA.** Linz, U. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nuklearchemie). Sep 1983. 136p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751498.

The consequences of the decay of iodine-125 incorporated into DNA were studied on a molecular basis. Doubly (^{14}C and ^{125}I) labelled 5-iodo-2'-deoxycytidine 5'-triphosphate (IdCTP) was synthesized and incorporated enzymatically into the SalI-cutting site of the plasmid pBR 322. Part of the radioiodinated DNA was treated with T4-DNA ligase in order to restore the circular structure of the native plasmid molecule. After 4 months of storage under various conditions the stable end products were analyzed by radio GC, radio HPLC and electron microscopy. The experiments were not only carried out with doubly-labelled DNA but also with solutions of ^{14}C-labelled DNA containing Na^{125}I as internal radiation source. The results clearly indicate that radiolysis alone causes only minor damage. Transmutation of the covalently bound iodine, on the other hand, leads to complete destruction of the labelled nucleotide, giving rise to $^{14}CO_2$ and ^{14}CO as main products. The production of $^{14}CO_2$ which originates from both the base as well as the sugar component shows a strong solvent effect. The electron microscopy analysis of the DNA reveals that the local effects are always connected with at least one double strand break directly at the site of decay. In addition, one finds DNA double strand breaks in areas which are hundreds of base pairs apart from that site. Under certain circumstances most of the DNA molecules exhibit up to 10 breaks. A comparison between ligase-treated and untreated DNA shows that the configuration of the DNA and the position of the labelled nucleotide play in important role in the extent of the overall damage. It could be demonstrated that there is a linear correlation between gaseous fragmentation products and the number of double strand breaks.

34458 **(LA—9893-MS) Estimating the risks of cancer mortality and genetic defects resulting from exposures to low levels of ionizing radiation.** Buhl, T.E.; Hansen, W.R. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013855.

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Estimators for calculating the risk of cancer and genetic disorders induced by exposure to ionizing radiation have been recommended by the US National Academy of Sciences Committee on the Biological Effects of Ionizing Radiations, the UN Scientific Committee on the Effects of Atomic Radiation, and the International Committee on Radiological Protection. These groups have also considered the risks of somatic effects other than cancer. The US National Council on Radiation Protection and Measurements has discussed risk estimate procedures for radiation-induced health effects. The recommendations of these national and international advisory committees are summarized and compared in this report. Based on this review, two procedures for risk estimation are presented for use in radiological assessments performed by the US Department of Energy under the National Environmental Policy Act of 1969 (NEPA). In the first procedure, age- and sex-averaged risk estimators calculated with US average demographic statistics would be used with estimates of radiation dose to calculate the projected risk of cancer and genetic disorders that would result from the operation being reviewed under NEPA. If more site-specific risk estimators are needed, and the demographic information is available, a second procedure is described that would involve direct calculation of the risk estimators using recommended risk-rate factors. The computer program REPCAL has been written to perform this calculation and is described in this report. 25 references, 16 tables.

34459 **(LBL—17149) Cell proliferation kinetics and radiation response in 9L tumor spheroids.** Sweigert, S.E. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013398.

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Cell kinetic parameters, including population doubling-time, cell cycle time, and growth fraction, were measured in 9L gliosarcoma spheroids. These parameters were studied as the spheroids grew from 50 μm to over 900 μm in diameter. Experiments relating the cell kinetic parameters to the radiation response of 9L spheroids were also carried out. The major findings were that the average cell cycle time (T/sub c/), is considerably longer in large spheroids than in exponentially-growing monolayers, the radiosensitivity of noncycling (but still viable) cells in spheroids is not significantly different from that of cycling spheroid cells, and the radiation-induced division delay is approximately twice as long in spheroid cells as in monolayer cells given equal radiation doses. The cell loss factor for spheroids of various sizes was calculated, by using the measured kinetic parameters in the basic equations for growth of a cell population. 157 references, 6 figures, 3 tables.

34460 **(NUREG/CR—3590) Evaluation of isotope dilution mass spectrometry for bioassay measurement of uranium, plutonium, and thorium in urine.** Dyer, F.F.; May, M.P.; Walker, R.L.; Scott, T.G.; Caton, G.M.; Stokely, J.R. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 76p. (ORNL/TM—9006). NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84013641.

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A study was made to evaluate the sensitivity, precision and accuracy, and practicality of isotope dilution mass spectrometry (IDMS) for bioassay of uranium, plutonium, and thorium in human urine. The study showed that uranium at a concentration of 0.06 μg/L (0.04 pCi/L natural uranium), plutonium at 3 pg/L (0.2 pCi/L Pu-239), and thorium at 0.1 μg/L (0.01 pCi/L Th-232) could be measured with an uncertainty (RSD) of 10% using 10 ml samples. The lower limits of detection for uranium and thorium were set by background contamination, whereas the detection limit for plutonium was determined by chemical yield and intrinsic instrumental sensitivity factors. Precision and accuracy is excellent (~ 1 to 3%, RSD) at concentration levels where background contamination is insigificant and instrumental sensitivity is adequate. Comparison of IDMS with other methods shows the technique is more sensitive than conventional fluorometric methods but is similar in sensitivity to alpha-radioactivity measurement methods that utilize large sample volumes (1 L). Costs for urine analysis by IDMS ($60 to $100 per sample) are estimated to be considerably higher than cost for fluorometric analysis and approximately the same as the cost for alpha-radioactivity methods. Other methods that have been used or are currently under development are discussed. 100 references, 2 figures, 10 tables.

34461 **(ORNL—5981) PRESTO-PREP: a data preprocessor for the PRESTO-II code.** Bell, M.A.; Emerson, C.J.; Fields, D.E. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014172.

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PRESTO-II is a computer code developed to evaluate possible health effects from shallow land disposal of low level radioactive wastes. PRESTO-PREP is a data preprocessor that has been developed to expedite the formation of input data sets for PRESTO-II. PRESTO-PREP utilizes a library of nuclide and risk-specific data. Given an initial waste inventory, the code creates the radionuclide portion of the associated input data set for PRESTO-II. 2 references.

34462 (PNL-SA—10992) Health effects estimation for contaminated properties. Marks, S.; Denham, D.H.; Cross, F.T.; Kennedy, W.E. Jr. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 5p. (CONF-840512—12). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013251.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

As part of an overall remedial action program to evaluate the need for and institute actions designed to minimize health hazards from inactive tailings piles and from displaced tailings, methods for estimating health effects from tailings were developed and applied to the Salt Lake City area. 2 references, 2 tables.

34463 (TRI-PP—84-7) Interactive radiation dosimetry database. Giffin, N.M. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Feb 1984. 4p. (CONF-840202—26). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84901239.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

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A radiation dosimetry system using direct reading dosimeters and an on-line interactive database program running on a VAX 11/780 under the VMS operating system has been developed to record, monitor, and report on exposure records of TRIUMF personnel. It is written in VAX FORTRAN-77 using the RMS file management system. Direct reading dosimeters are signed out and in through a DEC VT-100 terminal and personnel records are updated and displayed immediately. Each record contains a year-long dose history, annual and quarterly summaries, and sliding totals for the previous twelve months, three months and two weeks. A great variety of reports and summaries can be generated either directly from the program or through associated routines that have common access to the data. 2 figures, 2 tables.

34464 Relative biological effectiveness in V79 Chinese hamster cells of the neutron capture reactions in boron and nitrogen. Gabel, D.; Fairchild, R.G.; Larsson, B.; Boerner, H.G. (Univ. of Bremen, West Germany). *Radiation Research;* **98**: No. 2, 307-316(May 1984). Contract AC02-76CH00016.

V79 Chinese hamster cells were irradiated in the presence of different amounts of boric acid with thermal neutrons at the Medical Research Reactor at Brookhaven National Laboratory. From the linear dose-survival curves observed, a D/sub 0/ value of 150 rad obtained with 250 kVp X rays between 10 and 0.01% survival, an extrapolated RBE value of 2.3 was calculated. By irradiation of the same line of cells with cold neutrons at the Institut Laue-Langevin, a D/sub 0/ value for the $^{14}N(n,p)^{14}C$ reaction of 77 rad was obtained, with a corresponding RBE value of 1.9.

34465 Multifractionation of ^{60}Co gamma-rays reduces neoplastic transformation in vitro. Hill, C.K. (Argonne National Lab., IL (USA)); Han, A. (Argonne National Lab., IL (USA); University of Southern California, Los Angeles (USA). Cancer Research Lab.); Buonaguro, F. (Naples Univ. (Italy). Ist. di Patologia Generale); Elkind, M.M. (Argonne National Lab., IL (USA); Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). *Carcinogenesis (New York);* **5**: No. 2, 193-197(Feb 1984).

Incidences of neoplastic transformation of 10T1/2 cells, derived from a C3H mouse embryo, were measured following irradiation of cells with ^{60}Co γ-rays delivered in single total doses, from 25 to 300 rads, or in different numbers of fractions, and with different time intervals between fractions. Throughout the range of total doses that was examined (25 - 300 rads) exposure of asynchronous, actively growing 10T1/2 cells to a dose of γ-rays in five equal daily fractions, rather than in a single exposure, results in a significant reduction in transformation frequency. The initial part of the induction curve fits a straight line quite well. The slope of the line for five daily fractions is approx. 3-fold less steep than that for single exposures. A further increase in the interfraction interval, to 48 h, or further reductions in the dose per fraction, led to additional decreases in the incidence of neoplastic transformation. These observations are consistent with a net 'error-free' repair of subtransformation damage as a result of protracted irradiation with ^{60}Co γ-rays.

34466 Is radiation an appropriate model for chemical mutagenesis and carcinogenesis. Bond, V.P. (Associate Director for Life Sciences and Safety Brookhaven National Lab. Upton, NY). pp 539-552 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—).

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter attempts to show why the quadratic, or "linear quadratic," relationship holds for organ dose-single cell radiation effects, and to explore the extension of this relationship to chemical exposures in general. Demonstrates that although the "$\alpha D + \beta D^2$ relationship" may be unexpected for normal pharmacologicalmedical dose-response relationships, a linear, no-threshold curve of this kind is expected for all stochastic-type (accidental or risk) situations with health consequences (e.g. all common accidents) including exposure to "low-level radiation" (LLR). Discusses the stochastic or risk approach, relevant radiobiology, and the stochastic for chemicals. Assumes that even though actual mutational rates cannot be expected to apply to the relevance of Tradescantia or any other single cell system as a predictor for mutagenesis and carcinogenesis in animals and man, the cardinal principles of genetics largely transcend species and the particular environment in which the cell is located. Concludes that with regard to LLR, the curve shapes and other relationships developed for Tradescantia would be expected to apply in principle to animal and human mutagenesis and carcinogenesis.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 32503, 32643, 32643, 32658, 32690, 32691, 32692, 34246, 34293, 34294, 34295, 34295, 34337, 34400, 34432, 34433, 34446, 34466

34467 (AD-A—137410/7) Chemical pretreatment. Effects on acetylcholine, behavior, and agent incapacitation. Final report 1 Oct 79-30 Sep 82. Harris, L.W.; Lennox, W.J. (Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD (USA)). 14 Sep 1983. 69p. NTIS, PC A04/MF A01.

The objective of this study were as follows: (1) to develop pretreatment regimens which are performance deficit-free when administered alone, and which are capable of protecting against nerve agent-induced lethality, (2) to test the effectiveness of deficit-free pretreatment regimens against nerve agent-induced lethality, and (3) to study cerebral acetylcholine levels, tissue AChE activity, and performance decrements in animals given pretreatment and exposed to nerve agent. Agent-induced performance decrements may be related to excessive levels of ACh at vital cholinergic synapses. Pretreatment with a carbamate (e.g., physostigmine) capable of entering the CNS prior to agent exposure will correct Soman-induced physical and behavioral incapacitation, as well as excessive levels of cerebral ACh. Pretreatment with pyridostigmine will not abolish Soman-induced debilitation or Soman-induced increases in cerebral ACh. These findings strongly suggest that it may be possible to formulate a performance decrement-free pretreatment regimen for man.

34468 (AD-A—137900/7) Action of cholinergic poisons on the central nervous system and effectiveness of potential antidotes. Annual report 1 Jul 81-30 Jun 82. Samson, F.; Nelson, S. (Kansas Univ., Kansas City (USA). Medical Center). Nov 1982. 31p. NTIS, PC A03/MF A01.

The research aim was to determine the effects of soman, related organophosphate toxins and potential antidotes on brain regional functions in rats: The (^{14}C)-2-deoxyglucose procedure (2-DG) was used for mapping brain regional glucose use. Quantitative autoradiography was used for muscarinic and nicotinic cholinergic receptors. The 2-DG procedure gives a quantitative measure of glucose utilization in brain regions and is in index of the 'functional activity' in brain regions and systems. Values were determined in

controls, rats with soman induced seizures, seizures induced by convulsants (DFP, strychnine, picrotoxin, pentylenetetrazol, penicillin) and soman pretreated with TAB. Brain regional cholinergic receptor maps were prepared and some regional muscarinic and nicotinic receptor densities have been quantified. Soman (112 micrograms/kg i.m.) causes strong, continuous seizures and a dramatic (2-6 fold) increase in the rate of glucose use in 10 major brain regions. Most intense increases were in septum, substants nigra reticularis and outer layer of hippcampal dendata gyrus. The overt seizures of rats induced by convulsants DFP, strychnine, picrotoxin, pentylenetetrazol and penicillin (in hippocampus) were strikingly different from that of rats with soman seizures. High doses (2X LD50) of soman in rats protected with TAB caused a 50% depression of glucose use in most brain regions. The effects of repeated soman exposure on muscarinic and nicotinic receptors are under study.

34469 **(AD-A—138715/8) Chemical carcinogen-induced changes in TRNA metabolism in human cells. Interim technical report 1 Oct 82-30 Sep 83.** Trewyn, R.W. (Ohio State Univ. Research Foundation, Columbus (USA)). 30 Nov 1983. 75p. NTIS, PC A04/MF A01.

It is hypothesized that transfer RNAs mediate endogenous promotion of carcinogenesis subsequent to chemical carcinogen initiation, and that without the appropriate changes in tRNA metabolism, the ultimate expression of the neoplastic state will not be attained. Current studies are concentrating on tRNA ribosyltransferase modification reactions which are considered to be the pivotal molecular aberrations in this process. A normal human cell culture model system responsive to phorbol ester tumor promoters was developed which allows the evaluation of the role of tRNA in promotion of carcinogenesis. Chronic exposure to the tumor promoters induces a transient 5 to 10-fold increase in the saturation density of human cells if the treatment is initiated at early population doublings in culture in medium supplemented with elevated levels of specific amino acids. A significant decrease in queuine modification in the anticodon of cellular tRNAs precedes the transient 5 to 10-fold increase saturation density, and queuine modification increases prior to the subsequent decrease in saturation density. The increase in queuine modification correlates to the induction of an endogenous queuine salvage pathway. Most importantly, the addition of excess exogenous queuine inhibits the transient increase in saturation density induced by the tumor promoters, i.e., it blocks the expression of a transformed phenotype.

34470 **(BNL—34807) Large animal model for health hazard assessment of environmental pollutants.** Chanana, A.D.; Joel, D.D.; Costa, D.L.; Janoff, A.; Susskind, H.; Weiss, R.A. (Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Stony Brook (USA). Health Science Center). 1984. Contract AC02-76CH00016. 5p. (CONF-8404149—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013230.

From International symposium on environmental pollution and man; Cape Town, South Africa (30 Apr 1984).

The requirements of large animals for the experimental assessment of human health hazards associated with inhaled pollutants are discussed. Results from studies designed to elucidate mechanisms controlling pulmonary function at the organismal, cellular and molecular level are presented. It is shown that studies in large animals permit technically sophisticated approaches not feasible in small animals and not permissible in man. Use of large animals also permits serial, non-invasive determinations of structural and functional changes which may be of temporal importance. 6 references.

34471 **(BNL—34847) Pollution and man, environmental pollution and man, the magnitude of the problem, historical aspects and definitions.** Cronkite, E.P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 6p. (CONF-8404149—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013228.

From International symposium on environmental pollution and man; Cape Town, South Africa (30 Apr 1984).

The history, scope, and magnitude of the problem of occupational exposure to byproducts energy and chemical production is discussed in terms of risk assessment. Target organs, characteristics of carcinogens, and bioassay techniques are delineated. 15 references. (ACR)

34472 **(BNL—34848) Benzene toxicity and how to approach the problem of chemical leukemogenesis.** Cronkite, E.P.; Drew, R.T.; Bullis, J.E. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 5p. (CONF-8404149—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013229.

From International symposium on environmental pollution and man; Cape Town, South Africa (30 Apr 1984).

We have studied the effect of varying concentrations of benzene in the inhaled air of mice being exposed 6 hrs/day, 5 days/wk., for from two weeks through 16 weeks and observed blood counts, absolute cellularity of bone marrow, levels of pluripotent stem cells, fraction of the stem cells in DNA synthesis, and/or the incidence of leukemia, and the development of solid tumors after cessation of exposure. 15 references, 2 tables.

34473 **(CONF-8405189—1) Decomposition of sparked SF_6 and cytotoxicity of SF_6 decomposition products.** Griffin, G.D.; Sauers, I.; Easterly, C.E.; Ellis, H.W.; Christophorou, L.G. (Oak Ridge National Lab., TN (USA)). 09 May 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012342.

From 4. international symnposium on gaseous dielectrics; Knoxville, TN, USA (3 May 1984).

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While previously reported that sparked SF_6 was cytotoxic to mammalian cells, SF_6 itself was without biological activity. Using quadrupole mass spectrometric analysis of sparked SF_6, we found the by-products to include SOF_2, SO_2F_2, SF_4, SOF_4, SiF_4, SO_2, and HF. We investigated the cytotoxicity of the decomposition products toward hamster lung cells using a colony formation assay. SO_2 and HF were not cytotoxic at any concentration tested. SO_2F_2 and SiF_4, although strongly cytotoxic at higher concentrations than found in sparked SF_6, were without cytotoxic activity at lower concentrations. SOF_2 concentrations of 2% were only weakly cytotoxic; 5% concentrations produced ~ 50% and 89% cell death following 1 and 4 h of exposure. SOF_4 had only weak cytotoxic activity at 0.2% concentration, although there was evidence of strong cytotoxic activity (>80% cell death) following 4 h of exposure to 1% SOF_4. SF_4 exhibited no significant cytotoxic activity at 0.5% concentration, although concentrations of 1 and 2% showed definite cytotoxicity, particularly after 4 h of exposure. 17 references, 6 figures, 1 table.

34474 **(DOE/NBM—4013441) Impact of O_3 on yield of four soybean cultivars (CSRCLAP).** Kress, L.W.; Miller, J.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013441.

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The specific objective of this study was to determine the effects of daily O_3 exposure on the yield of four soybean cultivars. The loss estimates produced by the model generated using these data are nearly identical to those produced from the model of nine other data sets (six cultivars) - 12.1% at 0.05 ppM O_3, 17% at 0.06 ppM, and 30.7% at 0.09 ppM. These data suggest that different soybean cultivars exposed to O_3 in different regions and in different years may be responding to the O_3 stress in a similar fashion in terms of yield loss. These data will be combined with the other data generated in the National Crop Loss Assessment Network (NCLAN) program to evaluate the effects of O_3 on crop yield. Future research will attempt to quantify the confounding effects of soil moisture stress on soybean sensitivity to O_3. 4 references, 3 figures, 5 tables.

34475 **(DOE/NBM—4013442) Impact of O_3 and SO_2 on soybean yield (CSRCLAP).** (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013442.

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This study was initiated to evaluate the effects of daily O_3 and periodic SO_2 exposures on the yield of two soybean cultivars. The experimental exposure regime was designed to simulate SO_2 exposures from a point source superimposed on a regional O_3 stress. The results confirm the O_3 sensitivity of soybean. They also suggest that even low SO_2 concentrations (0.10 ppM) near a point source

could cause substantial (≈ 7%) yield reduction. These data will be combined with data from five other field sites for evaluation of the effects of O_3 on important agricultural crops. In areas where the potential for O_3 and SO_2 to co-occur exists, these data may be particularly useful. 7 references, 3 figures, 5 tables.

34476 **(DOE/NBM—4013443) Impact of O_3 on winter wheat yield (CSRCLAP).** (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013443.

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The present study was initiated to provide further biological response data suitable for evaluating ambient air quality standards and for use in the NCLAN economic assessment of the consequences of O_3 exposure to crops. Specifically, the objective was to establish exposure-response relationships between yield of two important cultivars of soft red winter wheat (both examined in 1982) grown in the Midwest and chronic exposures to a range of O_3 concentrations. The O_3 sensitivity was somewhat less in 1983 than it had been in 1982. It may be that the conditions of excess moisture and high fertility allowed the plants to overcome the O_3 stress at near ambient concentrations. Alternatively, the data on Heggestad suggest that moisture stress may potentiate O_3 effects at near ambient concentrations. Our 1982 wheat may have been under moderate moisture stress and thus was more sensitive to ambient O_3. Winter wheat (Abe and Arthur-71) is still to be considered as more sensitive than grain sorghum or field corn and less sensitive than soybean. The cultivar Roland, however, is more sensitive than Corsoy soybean. 7 references, 4 figures, 4 tables.

34477 **(INIS-mf—8948) Labelled radioactive adenosine nucleotides for the determination of toxic action.** Tahbaz, Z. (Technische Univ., Vienna (Austria)). 1983. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780344.

Normal house flies have been fed with carrier free radiophosphate (phosphorus). Many phosphorous containing substances, including nucleotides, in the tissue of the housefly are labelled with radiophosphorus by this procedure. Suitable methods for processing and separation have been selected to isolate ^{32}P-ATP ^{32}P-ADP ^{32}P-AMD and ^{32}P-phosphate. Working at low temperature prevents chemical changes of the nucleotides. Extraction and thin layer chromatorgraphy proved effective separation procedures for preparing samples to measurement of the nucleotides. Autoradiographic techniques, scanning and liquid scitillation counting had been used for radioactivity measure radioactive zones of the chromatograms. The results of these measurements provide information concerning the normal composition of adenosin nucleotides in the tissues of the housefly. If the animals are exposed to toxic chemicals, to insecticides, the composition of the phosphate containing compounds may change. The concentration of ATP decreases while the concentration of phosphate increases. This can be very easily shown by scanning the chromatograms of the extracts of the muscles of houseflies after feeding the animals with radioactive phosphate. Using this method, it is possible to show the toxic action of insecticides upon the metabolism of adenosine-phosphates. The decrease of the radioactivity at the zone of ATP and the increase of the radioactivity at the phosphate zone corresponds to the toxic action of foreign chemicals like insecticides. By using this tracer technique, it may be possible to investigate the toxic action of several toxic chemicals, if they are applied at the same time, thus investigating synergetic actions of environmental poisons.

34478 **(NP—4770325) New kinds of forest damage in the Federal Republic of Germany.** (Bundesministerium fuer Ernaehrung, Landwirtschaft und Forsten, Bonn (Germany, F.R.)). 18 Oct 1983. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770325.

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According to preliminary results of the 1983 survey of forest damage the forest area affected comes up to 2,5 million ha. This means that one third of the overall forest area (34%) is damaged. The lowest damage category, No. 1, can be applied to the largest affected area (1,8 million ha = 25%). Medium damage (category 2) were found on 0,6 million ha (8,5% of the forest area) and 64 000 ha (= 0,9% of the forest area) are heavily damaged (category 3). The Federal Government faces the following requirements for environmental policy: attempts at reducing the emission of pollutants on a national level must be continued and strongly supported by additional use of instruments of market economy in order to make environmental measures more attractive; bearing in mind the great exchange of air pollution - across borders - one has to try harder and make more attempts at international measures for the reduction of pollutant emission in the EEC, the OECD, and the ECE, as well as in bilateral negotiations with the neighbouring countries. - The possibilities of forestry to analyse and alleviate damage as well as to reduce its ecological and economic consequences have to be fully exhausted and supported; research and development must be intensified and coordinated even more.

34479 **(NP—4770326) Topical report: Forest damage.** (Bundesministerium des Innern, Bonn (Germany, F.R.)). 6 Sep 1983. 29p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770326.

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Taking the present state of science into account, the Federal Government has to realize that great efforts have to be made in fighting the tree dying. This applies especially to anti-air pollution measures, no individual pollutant or group of emitters is to be emphasized exclusively. The Federal Government therefore distinctively welcomes and supports the plans for establishing a Foundation entitled "Forest in danger - a joint venture to save our forest". The Federal Government approves of the action programme "Save the Forest" agreed upon by the Federal Ministers who took part in it. It considers the programme to be an important instrument in fighting forest damage. The responsible Federal Departments were given instructions to enhance and carry out the measures necessary in order to put the action programme into practice.

34480 **(NP—4770332) Metabolic alterations of the lungs of rats after intratracheal application of genuine pit-extracted fine dusts.** Engemann, H.U. (Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet). 27 May 1982. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770332.

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300 female Wistar rats were divided into 14 test groups. The rats of each group received single intratracheal administrations of fine dust samples type BAT II as suspension in 0,5 ml physiological saline solution. After 6 months half the animals of each test group and after 12 months the remaining animals were killed. In the animals killed the wet weight of the lungs, the dust, oxyprolin and lecithin contents and the phospholipids and lipids in the lungs were determined. Both after the six and the 12 months test period the wet weight of the lungs and the oxiprolin, lecithine, phospholipid and total lipid contents were found independent of the different dust contents in the lungs of the test animals.

34481 **(ORNL—6035) Nutritional requirements and contaminant analysis of laboratory animal feeds.** Pal, B.C.; Russ, R.H.; Milman, H.A. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 109p. (EPA—560/6-83-005). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013519.

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The primary objectives of this report are to present information concerning the nutritional requirements of several commonly used laboratory animal species (i.e., mouse, rat, hamster, guinea pig, rabbit, and dog) and to discuss various aspects of the problem of contamination of laboratory animal feeds. In addition, this document discusses the different types of laboratory animal diets (e.g., open vs closed formula), the ingredients used in these diets, the interaction of dietary components, and the public comments received respective to the EPA proposed guidelines for the nutrient composition of laboratory animal diets. Much of the data are presented in tabular form. 567 references; 3 figures; 19 tables; 5 appendices.

34482 (ORNL/TM—9169) Chemical characterization and toxicologic evaluation of airborne mixtures: inhalation toxicology of diesel fuel obscurant aerosol in Spargue-Dawley rats. Final report, phase 2, repeated exposures. Dalbey, W.; Lock, S., Schmoyer, R. (Oak Ridge National Lab., TN (USA)). Jul 1982. Contract AC05-84OR21400. 100p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013770.

A series of repeated exposures of rats to aerosolized diesel fuel was performed to help establish indices of potential toxicity resulting from aerosol exposure and the relative importance of duration of exposures, the frequence of exposures, and aerosol concentration in the induction of observed lesions. Body weight and food consumption were recorded on a weekly basis. Assays were performed on selected animals within 1-2 days after the last exposure or after 2 weeks without exposure. Endpoints included number and phagocytic activity of pulmonary free cells, pulmonary function tests, neurotoxicity assays, clinical chemistry, organ weights, and histopathology. Data were analyzed by analysis of variance. After exposure, the primary target organ was the lungs. Focal accumulations of pulmonary free cells were observed in the lung parenchyma, associated with thickening and hypercellularity of alveolar walls. The number of lavaged pulmonary free cells correlated well with histologic observations, remaining elevated after two weeks without exposure. Lung volumes were altered by exposure, including increased FRC, decreased TLC, and decreased VC. Carbon monoxide diffusing capacity was decreased in several exposed groups also. None of the more systemic changes observed were considered to be of biologic significance, even though the exposure conditions were considered to result in a maximum tolerated dose. Frequency of exposure was the dominant variable over the range of parameters used in this study, 3 exposures/wk being more deleterious than 1/week. Variation in duration of exposure appeared to have very little effect and a dose-response was often not apparent with differences in concentration. 12 references, 13 figures, 18 tables.

34483 (ORNL/TM—9195) Chemical characterization and toxicologic evaluation of airborne mixtures: diesel fuel smoke particulate dosimetry in Sprague-Dawley rats. Jenkins, R.A.; Manning, D.L.; Maskarinec, M.P.; Moneyhun, J.H.; Dalbey, W.; Lock, S. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013769.

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The use of decachlorobiphenyl (DCBP) as a dosimetric tracer for a diesel fuel smoke aerosol is described. DCBP added to the fuel prior to aerosolization is distributed solely into the particle phase of the resulting smoke. DCBP is distributed uniformly throughout the aerosol particles, regardless of particle size. Determinations of DCBP in tissue extracts of rats exposed to DCBP-containing smoke were performed by purifying the extracts on activated Florisil, and subsequently analyzing them by gas/liquid chromatography with electron capture detection. The largest internal amounts of smoke were found in the lungs. Smoke levels in the upper respiratory tract were only a very small fraction of those found in the lungs. Significant amounts of DCBP tracer were found in the digestive tract following smoke exposure. At a given exposure duration, animals exposed at higher smoke concentrations had greater levels of smoke deposited in their lungs.

34484 (PB—84-161942) Effects of ozone or SO_2 on growth and yield of rice. Final report Jan-Dec 82. Thompson, C.R.; Kats, G.; Dawson, P.; Wolf, J.; Bytnerowicz, A. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). 3 Sep 1983. 53p. NTIS, PC A04/MF A01.

Three cultivars of rice produced commercially in California, M7, M9 and S201, were grown in pots, six plants per pot and were flooded continuously with tap water and supplied with all known mineral elements. The plants were provided with activated carbon filtered air to which ozone or SO_2 was added as a fumigant. Twenty greenhouses were divided randomly into 10 groups of two each. Twelve pots of each cultivar (36 pots/greenhouse) were fumigated with ozone and SO_2. Two greenhouses received carbon filtered air (controls). Final harvest showed that ozone reduced seed weight, height of plant and spikelets per panicle but increased number of panicles in all cultivars and reduced straw weight.

34485 (PB—84-163724) Preclinical toxicologic evaluation of 5-isoxazoleacetic acid, alpha-amino-3-chloro-4,5-dihydro- (nsc 163501), in dogs, monkeys, and cdf1 mice. Final report 24 Apr-13 Sep 78. Denine, E.P.; Stout, L.D.; Peckham, J.C.; Guarino, A.M.; Davis, R.D. (Battelle Toxicology Program Office, Vienna, VA (USA)). 10 Nov 1978. 459p. NTIS, PC A20/MF A01.

Also pub. as Southern Research Inst., Birmingham, AL. Rept. Nos. SORI-KM-78-586, and R-3980-V.

Dose-limiting gastrointestinal toxicosis was qualitatively similar in dogs, monkeys, and mice. In dogs and monkeys, anorexia and/or oligodipsia were cardinal signs. Severity of intoxication was indicated by progression to a diarrheal syndrome. Intoxication of the erythron was indicated in the dog and monkey studies. Quantitatively, mice were the most resistant to toxicity, and monkeys were more resistant than dogs. In dogs, fractionation of a single dose to five daily doses resulted in marked cumulative toxicity. Further fractionation to 10 daily doses produced only additive intoxication. Fractionation of a single dose to weekly doses offered some protection from additive toxicity. Similar results were obtained when 5 daily doses were fractionated to three 5-day courses of treatment separated by 9-day rest periods.

34486 (PB—84-167212) California commercial/sport fish and shellfish oil toxicity study. Volume 1. Executive summary. Final report. Kanter, R.G.; Wingert, R.C.; Vick, W.H.; Sowby, M.L.; Foley, C.J. (MBC Applied Environmental Sciences, Inc., Costa Mesa, CA (USA)). Dec 1983. 35p. NTIS, PC A03/MF A01.

See also PB84-167220. Prepared in cooperation with Science Applicatons, Inc., La Jolla, CA.

The effect of oil on three species of California marine organisms, California Halibut (Paralichthys californicus), Northern Anchovy (Engraulis mordax), and California Mussel (Mytilus californianus) were investigated. Adult, larval, and egg life stages of each species were exposed to the water soluble fraction (WSF) of Santa Barbara crude oil in flow-through experiments lasting through the life stage or as long as 120 days. Embryos of all species accumulated hydrocarbons and showed reduced survival with increasing test concentration. Larval halibut demonstrated bent notochords in high test concentration, reduced growth rate in all concentrations, and gill damage in adults in high concentration. Anchovy larvae and adults showed patterns similar to halibut with reduction in growth and head and jaw abnormalities.

34487 (PB—84-170687) Monticello experiment: a case study. Cooper, W.E.; Stout, R.J. (Michigan State Univ., East Lansing (USA)). 1984. 45p. NTIS, PC A03/MF A01.

A number of assumptions are inherent in the process of using animal toxicity tests to determine water quality characteristics that can be considered safe for aquatic life. These assumptions, expressed as hypotheses, include: (1) the transfer of laboratory acute toxicity tests to a field situation is possible without serious distortion; (2) multispecies or community level responses to toxicity exposure will not be markedly different from single-species responses; and (3) intermittent exposures with short time intervals between events will produce the same ecological responses as a continuous exposure of the same concentration-time integral. These hypotheses were tested in two recycling stream ecosystems at the Monticello Ecological Research Station of EPA's Duluth, Minnesota Environmental Research Laboratory.

34488 (PB—84-172519) Health hazard evaluation report No. HETA 80-197-1215, Pacific Gas and Electric-Geysers facility, San Francisco, California. Belanger, P.L.; Coye, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1982. 16p. NTIS, PC A02/MF A01.

On August 7, 1980, NIOSH conducted an initial environmental and medical survey of three power plant facilities (units 3/4, 11, and 15) at the Geysers. On December 16-17, 1980, NIOSH conducted a follow-up environmental survey to evaluate employees ex-

posure to vanadium pentoxide, inorganic mercury and arsenic, nuisance dust, sodium hydroxide, and asbestos. No vanadium pentoxide, sodium hydroxide, asbestos, or inorganic mercury was detected. Medical interviews revealed concerns regarding a suspected high incidence of heart attacks, hypertension, and stress. A case-finding questionnaire was sent to all Geysers employees asking for information on heart attacks among workers under age 65. It was not possible to design an epidemiologic evaluation of the potential hypertension or stress-related symptoms because of the lack of an adequate comparison group.

34489 **(PB—84-172774) Health hazard evaluation report No. HETA 81-062-1211, Hatfield's Ferry Power Station, Masontown, Pennsylvania.** Chrostek, W.; Parkinson, D.K. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Oct 1982. 24p. NTIS, PC A02/MF A01.

On November 11, 1980, NIOSH received a request to evaluate employee exposures to asbestos, fly ash, coal dust, and sulfur dioxide. Analysis of the benzene soluble samples for five polynuclear aromatic hydrocarbons - benzo(a)pyrene, chrysene, pyrene, benzo(a)anthracene, and fluoranthene - showed levels below the laboratory limit of detection for each sample. For a number of years the company has had a comprehensive program for asbestos removal and control, but careless handling by contractors could result in asbestos contamination/exposures. The company has an adequate respirator program. The medical evaluation included a respiratory questionnaire and measurement of blood pressure.

34490 (STF—21A82101, pp 75) **Microbiology II. Biodegradation of oil - 1981. Study results.** Eimhjellen, K.; Nilssen, O.; Josepsen, K.; Sommer, T.; Sveum, P.; Hoddo,T. 1982. NTIS (US Sales Only), PC A04/MF A01. Order Number TI84751020. (BIOS/WR—81-6).

Bound as an appendix to the Norwegian Final Administrative Report for the Baffin Island Oil Spill Project.

In Final administrative report,The BIOSIS-project/. Canada 1980-1982.

During the weeks of postspill sampling no drastic changes in the population of total viable heterotrophic bacteria (THV) and oil degrading bacteria (ODB) were recorded. Significant increases of ODB were registered in surface water and 5 m water above the levels in corresponding samples from the control bay. In the sediment samples no effects of the oil spill could be found. In experiments using tritiated Lago Medio crude oil the rate and level of oil mineralization was assessed in samples of sediments and in water of 5 m depth. All the analyzed samples could mineralize ^{3}H-Lago Medio oil as well as n-hexadecane. Only a minor percentage of the samples exhibited ability to mineralize ^{14}C-naphthalene and benzopyrene. The test plots oiled in 1980 had enhanced levels of TVH,ODB and respiratory carbon dioxide production compared to unoiled plots. The crude oil plot had less remaining oil than the oil-emulsion plot. Several new test plots with oil-emulsion were prepared. No stagnation in the respiratory carbon dioxide production as registered in 1980 was recorded. After treating the oiled sand with BP solidifying agent about 50% of the oil could be removed manually and enhanced respiratory activity resulted. The addition of composite fertilizer at all levels supported a rapid increase in bacteria, carbon dioxide production and in ODB in the oil-sand layer. 16 figures, 20 tables.

34491 **Deposition and fate of inhaled ethylene glycol vapor and condensation aerosol in the rat.** Marshall, T.C.; Cheng, Y.S. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Fundamental and Applied Toxicology;* 3: No. 5-6, 175-181(May-Jun 1983). Contract AC04-76EV01013.

Fischer-344 rats were exposed by nose-only inhalation for 30 min to ethylene glycol-^{14}C vapor at a concentration of 32 mg/m^{3}. A second group of rats was exposed for 17 min to an ethylene glycol-^{14}C aerosol formed by condensation of the glycol on 0.1 m $^{67}Ga_2O_3$ particles. The mass median aerodynamic diameter (MMAD) of the condensation aerosol was 2.3 μm (sigma g = 1.8) with an ethylene glycol concentration of 184 mg/m$_3$. Initial radiocarbon body burdens were at glycol levels of 0.7 mg/kg for the vapor exposure and 2.4 mg/kg for the aerosol exposure. Estimates indicated that at least 60% of the ethylene glycol inhaled for both exposures was deposited in rats with the highest concentration of radioactivity being in the nasal cavities. Distribution from the site of deposition was rapid since 75 to 80% of the initial body burden was found throughout the bodies of rats sacrificed immediately after exposure. The predominant routes of elimination during the first 4 days following exposure were via the expired air as $^{14}CO_2$ (63% for the vapor exposure and 70% for the aerosol exposure) and urine as the unchanged glycol (20% and 11%). The proportion of the doses excreted as $^{14}CO_2$ suggested more complete metabolism of ethylene glycol following inhalation relative to that observed after intravenous injection reported previously. The studies suggested that ethylene glycol plasma levels following acute exposure to high airborne concentrations of ethylene glycol vapor and/or aerosol would not approach the toxic concentrations associated with known dose-dependent changes in the glycol's metabolism.

34492 **Evaluation of biological indicators of body burden of cadmium in humans.** Ellis, K.J.; Yasumura, S.; Vartsky, D.; Cohn, S.H. (Brookhaven National Lab., Upton, NY). *Fundamental and Applied Toxicology;* 3: No. 5-6, 169-174(May-Jun 1983). Contract AC02-76CH00016.

The cadmium content in the left kidney (KCd) and concentration in the liver (LCd) were measured in vivo in 51 adult male workers actively employed at a cadmium plant and in 10 nonexposed controls. Cadmium levels in blood (BCd), urine (UCd) and hair (HCd) were also obtained for each subject. When the workers were classified on the basis of urinary excretion of β_2-microglobulin, albumin and total protein, 33 workers were judged to have normal renal function, and 18 workers were found to have renal dysfunction. In the two groups of industrial workers the mean value for each biological index of cadmium exposure was statistically elevated when compared with the mean value for the controls. Examination of the interrelationships among KCd, LCd, BCd, UCd and HCd provided the following conclusions: (a) Only on a group basis was UCd correlated (r = 0.61) with KCd in workers with normal renal function; (b) BCd was corrected with LCd in workers with normal kidney function (r = 0.53) and in workers with renal dysfunction (r = 0.68); (c) HCd had the largest variability of the biological indices and was unrelated to body burden; (d) KCd and LCd were positivley correlated in workers with normal kidney function, whereas KCd decreased with increasing LCd in workers with renal dysfunction. This study demonstrates that the qualitative nature of the relationship of BCd, UCd and HCd (biological indices of exposure) with KCd and LCd (body burden) is not sufficiently quantitative for predicting the body burden of an individual worker.

34493 **Techniques for the generation and monitoring of vapors.** Nelson, G.O. (Lawrence Livermore National Lab. Livermore, CA). pp 197-207 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—). Contract W-7405-ENG-48.

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter examines the preparation and measurement of test atmospheres for animal exposure experimentation; points out that test gas and vapor mixtures must be produced continuously and dynamically to prevent a build-up of unwanted contaminants in the exposure chamber; discusses gas and vapor mixture generation techniques (flow dilution, solvent injection, saturation, permeation tubes, diffusion tubes); gas detection and monitoring techniques (hydrocarbon analyzers, photoionization detectors, electrochemical analyzers, infrared analyzers); and an ideal contaminant generation and measurement system; concludes that controlled test atmospheres can be produced using a variety of techniques, and the resulting concentrations of gas mixtures can be monitored and measured using flame ionization or photoionization techniques and recommends that electrochemical and infrared analytical systems be used if greater specificity is desired.

34494 **Genotoxic effects of airborne agents.** Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). 658p. (CONF-8002106—).

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This book explores the genotoxic effects of specific airborne agents and details current in vitro and in vivo methods for assessing their genotoxic potential. Describes analytical and exposure techniques covering microbial to mammalian cell to plant to whole-animal exposures. Examines benzene, a common constituent of gasoline; vinyl chloride, a chemical used in plastics; radon, a radioactive gas released from uranium tailings; and other pollutants. Discusses technical difficulties inherent to the generation of vapors and particulates; the extrapolation of data to human health effects; the monitoring of populations for genotoxic damage; and regulatory risk policy. Constitutes the proceedings of the Symposium on Genotoxic Effects of Airborne Agents held in 1980 at the Brookhaven National Laboratory, NY.

34495 **Cytogenetic effects of inhaled benzene in murine bone marrow.** Tice, R.R.; Costa, D.L.; Vogt, T.F. (Medical Dept. Brookhaven National Lab. Upton, NY). pp 257-275 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—).

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter examines the ability of benzene to induce chromosomal aberrations or sister chromatid exchanges (SCEs) and to inhibit cellular proliferation in murine bone marrow. Uses cytogenetic methodologies based on the incorporation of 5-bromodeoxyuridine (BrdUrd) into DNA. Mice were exposed to benzene by inhalation. An attempt to assess: benzene's ability to induce different kinds of genotoxic damage; the importance of concentration, age, sex, and genetic constitution in modulating benzene's geotoxic potency; and the relationship between liver-specific metabolism and extrahepatic metabolism in determining the observed cytogenetic effects. Concludes that different metabolites of benzene may be responsible for the induced chromosomal aberrations and SCEs and for the inhibition of cellular proliferation in bone marrow tissue in older mice; the liver may not be the main site of production for the SCE-inducing metabolite; a 4-hr. exposure to ambient concentrations of benzene as low as 28 ppm induces a significant increase in bone marrow genotoxic damage as measured by SCE formation; age, sex and genetic constitution are important when extrapolating animal data to human health risks; two different routes of benzene exposure for genotoxic damage can be directly correlated; and the pharmacokinetic, metabolic and molecular mechanisms involved in benzene's ability to cause anemia and leukemia are extremely complex.

34496 **Cytogenetic monitoring of human populations.** Galloway, S.M.; Rice, R.R. (Litton Bionetics, Inc., Kensington, MD). pp 463-488 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—).

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter examines the use of lymphocyte chromosomes to detect damage to genetic material. Explains that studies of chromosomes of peripheral blood lymphocytes can enable the evaluation of chromosomal aberrations, sister chromatid exchanges (SCEs), the frequency of dividing cells, and the rate of cell proliferation. Discusses chromosomal changes (morphology and mechanism of formation); applications of cytogenetic studies to human populations; and possible cytogenetic detection of individuals susceptible to cancer (chromosomal damage and cancer; detection of cancer prone individuals). Concludes that cytogenetic monitoring is the only established means of detecting damage to the human genetic material. Suggests that it is possible that the use of cytogenetics tests for in vitro susceptibility to chemical damage may be developed to identify individuals at particular risk from chemicals.

34497 **Impact of energy and industrial pollution on public health.** Morris, S.C. III. (Biomedical & Environ. Assessment Division Brookhaven National Lab., Upton, NY). pp 555-577 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. New York, NY; Plenum Publishing Corp. (1982). (CONF-8002106—).

From Associated Universities, Inc./Brookhaven National Laboratory Medical Department symposium on genotoxic effects of airborne agents; Upton, NY, USA (9 Feb 1980).

This chapter demonstrates that considerable cancer is due to exposure to industrial and chemical pollutants, especially among workers. Derives dose-response functions from high dose situations (frequently occupational exposures) and applies them to low dose situations functions. Finds that people living in the immediate vicinity of industrial plants releasing pollutants are at increased risk for cancer; the least documented situation is whether there is an increased risk for cancers among the general public due to widespread, low level chemical exposure in air and water; the risk to the public from diesel exhaust is predicted to be extremely low; and the introduction of a new pollutant that is probably a carcinogen and to which millions will be exposed is a difficult problem for policy makers to face.

5604 Other Environmental Pollutant Effects

34498 **(AD-A—137664/9) Study of low level laser retinal damage. Annual progress report 1 Feb 83-31 Jan 84.** Hochheimer, B.F. (Johns Hopkins Univ., Silver Spring, MD (USA). Applied Physics Lab.). 1 Feb 1984. 55p. NTIS, PC A04/MF A01.

The general objective of this program is to document changes in the retina due to very low laser irradiation. We have two primary aims. One is to develop and improve methods that can be used, in vivo, to objectively determine changes that occur in the retina from laser irradiation. The second is to determine the mechanisms that cause these retinal changes. During this past year we have: (1) Measured the change in retinal reflectivity during YAG and Argon Ion laser burn periods. (2) Determined the fluorescence decay time of fluorescein dye in water, blood and monkey retinas. (3) Obtained estimates of the amount of scattered light in the eye in the green and red spectral regions.

57 HEALTH AND SAFETY

34499 **(DOE/NV/10327—8) Cross-index to DOE-prescribed occupational safety codes and standards.** (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA). Occupational Safety and Fire Protection Services). Jan 1984. Contract AC08-84NV10327. 572p. NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE84013538.

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This Cross-Index is the 1983 compilation of detailed information from more than three hundred and sixty DOE-prescribed or OSHA-referenced occupational safety codes, transportation safety codes, and fire protection codes and standards.

34500 (INIS-mf—8903, pp 155-156) **Basic international safety standards for radiation protection.** Schlesinger, T.; Shamai, Y. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34501 **(LA—10078-MS) High-efficiency particulate air filter behavior at high-speed flows.** Tang, P.K.; Gregory, W.S.; Ricketts, C.I.; Smith, P.R. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014137.

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This paper presents a filter model based on the principle of fluid flow through porous media. The model includes both laminar and turbulent effects. The coefficients used in the model are determined empirically based on existing data. Deviation from the model is discussed.

34502 **(NE-F—3-42-6-84) Operating policy of DOE filter test program.** (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 8p. Nuclear Standards Management Center, P.O. Box Y, Oak Ridge, TN 37831. Order Number TI84013306.

This standard establishes policies and procedures for the operation of US Department of Energy (DOE) Filter Test Facilities (FTF) at Oak Ridge, Tennessee; Golden, Colorado; and Richland, Washington.

34503 **(NE-F—3-43-6-84) Quality assurance testing of HEPA filters and respirator canisters.** (Oak Ridge National Lab., TN (USA)). 22 Jun 1984. Contract AC05-84OR21400. 33p. NSMC-ORNL, Box Y, Oak Ridge, TN 37830. Order Number TI84013308.

This standard covers requirements for the quality assurance inspection and testing of HEPA filters and respirator canisters by the US Department of Energy (DOE) Filter Test Facilities (FTFs) at Oak Ridge, Tennessee; Golden, Colorado; and Richland, Washington. The standard provides a basis for the preparation of written procedures for conducting primary FTF functions. These standards apply only to filters used at DOE installations for environmental protection purposes. These filters are described as Type B filters in Institute of Environmental Sciences HEPA Filter Practices, IES Designation RP-CC-001.

34504 **(NE-F—3-44-6-84) DOE filter test facilities quality program plan.** (Oak Ridge National Lab., TN (USA)). 22 Jun 1984. Contract AC05-84OR21400. 8p. NSMC-ORNL, Box Y, Oak Ridge, TN 37830. Order Number TI84013307.

This document covers scope, applicable documents, quality program plan preparation, requirements, control of nonconforming items and corrective actions, audits, and training. (DLC)

34505 **(NE-M—17-1T-6-84) Sodium carbonate, low-chloride fire extinguishing agent.** Eichelberger, R.L. (Oak Ridge National Lab., XN (USA)). 29 Jun 1984. Contract AC05-84OR21400. 14p. Nuclear Standards Management Center-ORNL, P.O. Box Y, Oak Ridge, TN 37831. Order Number TI84013988.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 32714, 32739, 32743, 32754, 32755, 32757, 33781

34506 **(ANL/ES—137-Pt.1) Crystalline rocks of the northeastern United States.** Harrison, W.; Flower, M.; Sood, M.; Tisue, M.; Edgar, D. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 330p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84013673.

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This report is a compendium of the available information on exposed crystalline rocks in Maine, New Hampshire, Vermont, northeastern New York (Adirondack Mountains), Massachusetts, Rhode Island, Connecticut, southeastern New York, northern New Jersey, and southeastern Pennsylvania. Crystalline rocks are defined in this report as bodies of medium- and coarse-grained igneous and high-grade metamorphic rocks. The study was undertaken to provide background information to assist in evaluating the geologic suitability of such rocks for isolating high-level radioactive waste. Available information describing the size, shape, and location; relative and absolute age; origin; petrography; secondary intrusions; country rock; structure; and geophysical characteristics is presented for each crystalline rock body in the study region that has an area of at least 78 km² (30 mi²). 55 figures, 9 tables.

34507 **(ANL/ES—137-Pt.2) Crystalline rocks of the northeastern United States.** Harrison, W.; Flower, M.; Sood, M.; Tisue, M.; Edgar, D. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 106p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84013674.

This report is a compendium of the available information on Vermont, northeastern New York (Adirondack Mountains), Massachusetts, Rhode Island, Connecticut, southeastern New York, northern New Jersey, and southeastern Pennsylvania. Crystalline rocks are defined in this report as bodies of medium- and coarse-grained igneous and high-grade metamorphic rocks. The study was undertaken to provide background information to assist in evaluating the geologic suitability of such rocks for isolating high-level radioactive waste. This volume contains maps of the major crystalline rock associations and faults of the northeastern US.

34508 **(DTH-ISVA—33) Simulation of water flow in the unsaturated zone including the root zone.** Hoeg Jensen, K. (Danmarks Tekniske Hoejskole, Lyngby. Inst. for Stroemningsmekanik og Vandbygning). May 1983. 247p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE84751000.

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A one-dimensional soil water flow model has been developed based on a finite difference approximation of the governing differential equation. In the flow equation is included a sink term representing the moisture extraction by root systems, and allowance for evaporation from the soil surface is made too. Estimation of these terms is based on a potential transpiration calculated from the Penman-Monteith equation, on a potential soil evaporation calculated from the Ritchie equation and in both cases on relations to soil moisture availability over various foil depths. In addition an interception description is included. The performance of the model is tested against extensive data collected from field studies of agricultural crops at two locations in Denmark, which represent two different soil conditions. Measured and simulated soil water contents and soil water pressure heads compare well. The physical basis of the model provides a potential for a wide range of applicatons and allows for a prediction of the effect of human activities. In this respect the model has been applied for predicting the consequences of irrigation on the hydrologic subprocesses of evapotranspiration and deep percolation. This prediction has been validated against measurements. The soil water flow model may be included in a distributed and physically based hydrologic catchment model to link the processes of overland and channel flow and groundwater flow. Since the model describes the variation of water flow and moisture content throughout the profile, it provides the necessary input for the calculation of the transport and dispersion of solutes in the soil profile.

34509 **(UCRL—89787) Historical controversies in the geological sciences.** Schock, R.N. (Lawrence Livermore National Lab., CA (USA)). 17 May 1984. Contract W-7405-ENG-48. 24p. (CONF-8308149—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012808.

From Conference on glass in planetary and geological phenomena; Alfred, NY, USA (14 Aug 1983).

The dispute over the origin of tektites, either in its scope or in the ferocity of the arguments, is typical of disputes which have characterized the geological sciences for at least 250 years. In view of the impossibility of reconstructing the events which created the debated result, it is perhaps surprising that even more controversies have not erupted. A review of the literature of these controversies suggests several points to consider that might if taken facilitate the resolution of the dispute with benefit to the progress of science. The first of these is to contemplate your arguments in the context of those of your detractors, not solely in terms of your own ideas. Make careful field observations, not only laboratory observations and theoretical arguments; the record of the natural event is in the field, not the office or the laboratory. Search for outrageous hypotheses and then test and refine them to see of some new insight is gained. Finally, look for the simplest explanation; it is likely to be

elegant despite its dress and it probably will be correct. 26 references, 1 figure.

5802 Geophysics

REFER ALSO TO CITATION(S) 32587, 32602, 32649, 32762

34510 **(INIS-BR—118) Brazil-Angola alkaline - carbonatite province and its main economic aspects.** Loureiro, F.E.V.L.; Di Valderano, M.H.W. (NUCLEBRAS, Rio de Janeiro (Brazil)). (NUCLEBRAS, Rio de Janeiro (Brazil)). 1982. 12p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780340.

The principal characteristics of the Brazil-Angola Alkaline Carbonatite Province are defined and described with specific reference to tectonic setting and economic aspects. The economic aspects of the Brazilian uranium deposits are emphasised. The Brazil-Angola Alkaline-Carbonatite Province can be divided into six Brazilian sub-provinces and two Angolan sub-provinces. Correlation between the sub-provinces of Brazil and Angola remains speculative due to the lack of detailed information, especially age determinations on the Angolan rocks. However, an analysis of the tectonic and petrochemical aspects suggests that the two Brazilian sub-provinces situated along the littoral of Rio de Janeiro/ Sao Paulo and around the periphery of the Parana Basin may be more easily comparable to the two Angolan sub-provinces than the remaining four. (Author).

34511 (INIS-mf—8473, pp 342-350) **Historic eastern Canadian earthquakes. A reappraisal of near-field effects.** Asmis, G.J.K.; Atchison, R.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 1983. NTIS (US Sales Only), PC A19/MF A01. Order Number TI84780007. (CONF-8106200—PT.1; INFO—0039).

From 21. annual international conference of Canadian Nuclear Association and 2. annual conference of Canadian Nuclear Society; Ottawa, Canada (8 Jun 1981).

One would expect that near-field effects will be manifested near any earthquake, including any eastern Canadian earthquake. However is there any evidence of such effects, and how pertinent are data from the west coast of the United States to eastern Canada(question mark). To answer this question we have (a) reviewed the history of the three strongest earthquakes--St. Lawrence (1925), Temiskaming (1935), Cornwall (1944)--that have occurred in ΣmodernΣ times; (b) reviewed near-field strong motion records that have been collected by the USGS for the two year period 1978-1979, and carried out field studies to determine the extent of damage and non-damage to industrial facilities; and (c) carried out limited finite difference numerical modelling based on physical properties to simulate accelerograms for near-field motion.

34512 (INIS-mf—8903, pp 98-100) **Aerial radiometric survey over Israel.** Rapaport, M.S.; Vulkan, U.; Aviv, R. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Itamar, I. (Ministry of Energy and Infrastructure, Jerusalem (Israel). Geological Survey of Israel). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34513 **(STF—28A83010) Seismic migration using the WKB approximation.** Ursin, B. (SINTEF, Trondheim (Norway)). Apr 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751030.

The linear acoustic equations for a horizontally layered medium are transformed into two coupled differential equations for the upgoing and downgoing wavefield. The zero-order and first-order WKB approximations are used to derive two new prestack migration algorithms for common-source point areal seismic data. It is shown that the Hankel transform may be used in the prestack migration of seismic line data. An exact equation is derived for zero-offset seismic data. Neglecting second-order derivatives with respect to offset coordinates results in an inhomogenous acoustic wave equation with half the velocity and twice the density of the real medium. The zero-order and first-order WKB approximations are used to derive two new algorithms for the migration of stacked seismic data.

34514 **(STF—28A83013) Interaction between airguns.** Vaage, S.; Ursin, B.; Haugland, K. (SINTEF, Trondheim (Norway)). May 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751031.

In the design of linear airgun arrays the non-linear interaction between the airguns is neglected. The different formulas which have been proposed for the minimum seperation between airguns at which the non-linear interaction is neglible, are reviewed. A large number of measurements in order to establish the amount of interaction between two airguns of various volumes at different pressures and depths has been analyzed. The changes in primary pulse amplitude, bubble period and primary/bubble peak-to-peak amplitude ratio are computed from the measurement data as a function of airgun separation, chamber volume, chamber pressure, and airgun depth. The influence of using a waveshape kit is investigated, and the effects of interaction and the effects of using a waveshape kit are compared. 9 drawings, 1 table.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 32588, 32676, 32727, 32739, 32740

34515 **(DP-MS—82-32) Effect of porosity and NaCl concentration on the osmotic efficiency of a sodium bentonite membrane.** Fritz, S.J.; Marine, I.W. (Texas A and M Univ., College Station (USA). Dept. of Geology; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 26p. (CONF-8210103—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013818.

From Geological Society of America meeting on geochemistry of radionuclide migration/retardation; New Orleans, LA, USA (18 Oct 1982).

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Osmosis has been cited as a mechanism for explaining anomalously high fluid pressures in the subsurface. Clays and shales act as membranes, and osmotic flux across these units may result in pressures sufficiently high to explain these anomalies. The theoretical osmotic pressures as calculated solely from solution properties can be quite large; however, it is not yet resolved whether these geologic membranes are sufficiently ideal to generate such pressures. Osmotic efficiencies of a Na-bentonite were measured by a series of hyperfiltration experiments using various molarities of NaCl at two different porosities. The highest osmotic efficiency (0.8912) occurred at the lower porosity and the lowest NaCl input solution. The lowest measured osmotic efficiency (0.0423) occurred at the higher porosity and the highest NaCl input concentration. 26 references, 2 figures, 2 tables.

34516 **(DPST—71-332) Mineralogy and ion exchange characteristics of Savannah River Plant streambed sediments.** Hawkins, R.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). May 1971. Contract AC09-76SR00001. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013117.

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Samples were collected of bottom sediments from three Savannah River Plant (SRP) streams and of soils from the source areas of the sediments. The samples were analyzed for clay and organic matter contents, cation exchange capacity (CEC), and mineralogy of the sand, silt, and clay fractions. The results lead to the following conclusions: quartz is the dominant mineral in the sand and silt fractions; kaolinite is the dominant mineral in the clay fractions; no illite, chlorite, vermiculite, or montmorillonite minerals are present; the average clay content of the sediments is 32% by weight; the average organic matter content of the sediments is 1.26% by weight; the average CEC of the sediments is 2.61 meq per 100 g; and the highest sorptive capacity is in the downstream sediments near and in the Savannah River swamp. 21 references, 5 figures, 1 table.

34517 **(INIS-mf—8941) Annealing of vacancies induced by nuclear radiation in natural apatite by annealing at high temperatures.** Girstmair, A. (Innsbruck Univ. (Austria)). 1982. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780338.

Thermal annealing of fission tracks is an important problem of the age determination in minerals by the fission track method. The present work extends previous investigations on track annealing in natural apatite towards higher temperatures. Annealing times of a few minutes and temperatures of 300, 395, 422, 488 deg C were investigated and attempts were made to fit the data by a formula valid at lower temperatures. Surprisingly there is a sharp deflection in the Arrhennius plot of the annealing coefficient $\alpha(T)$ from linear around 370 deg C, i.e. a decrease of heating. The conditions of the experiment resemble those prevailing in meteorites entering the earth atmosphere. (G.Q.).

34518 **(INIS-mf—8950) Application of the fission track method to determination of temperature aging and of uranium concentrations. Absorption spectroscopy in apatite for investigation of the healing mechanism of radiation defects.** Ritter, W. (Innsbruck Univ. (Austria)). 1982. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780339.

In part I fission track counting has been applied to a) age determination of apatite and titanite from Sweden and an estimation of their initial temperatures b) determination of uranium content of waters from droplets evaporated on plastic foils. In part II absorption spectrometry was used to investigate the recovery from radiation defects in natural apatite. Conclusions are drawn on the radiations defect healing mechanism during annealing. Part of the content of this work has already been published in journals and conference papers. (G.Q.).

34519 **(LA-UR—84-924) Numerical creep analysis.** Anderson, C.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840833—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009969.

From 5. American Society of Civil Engineers/Engineering Mechanics specialty conference; Laramie, WY, USA (1 Aug 1984).

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A large deformation creep algorithm is presented that includes pore pressure and fluid migration effects. Its application is illustrated by the numericl analysis of rock folding with attendant fluid migration. 6 references, 2 figures. (ACR)

5804 Geochemistry

REFER ALSO TO CITATION(S) 32730, 32742, 32758, 34510

5805 Oceanography

34520 **(PB—84-145192) Benthic boundary layer. IOS (Institute of Oceanographic Sciences) observational programme interim report, January 1983.** Saunders, P.M. (Institute of Oceanographic Sciences, Godalming (UK)). 1983. 35p. NTIS, PC E04/MF E04.

Measurements have been made over a period of seven months of currents and mixing near the seabed. The location of the study was in the N. Atlantic approximately midway between the islands of the Azores and Madeira. Currents were measured near the seabed in a water depth exceeding 5000m with moored internally-recording instruments. Maps of near bottom flow have been constructed and the dispersion of particles of water and therefore mixing of a tracer, such as radionuclide has been inferred. The research described in this report is concerned with a small part of the scientific assessment of the feasibility of the disposal of heat generating radioactive waste (HGW) into the deep sea environment.

64 PHYSICS. I.

34521 **(INIS-BR—107) Progress report 1981-1982 - Instituto de Fisica - Universidada Federal do Rio Grande do Sul.** (Rio Grande do Sul Univ., Porto Alcgre (Brazil). Inst. de Fisica). 1983. 206p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

Abstracts of individual items from the report were prepared separately for the data base. (GHT)

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 34557

34522 **(AD-A—137163/2) Study of coronal precursors of solar flares. Final report 26 Jan 82-25 Jul 83.** Webb, D.F. (American Science and Engineering, Inc., Arlington, MA. Space Systems Div.). Aug 1983. 49p. (ASE—4818). NTIS, PC A03/MF A01.

This contract was to investigate the evidence for the characteristics of solar coronal flare precursors using high spatial resolution Skylab soft X-ray, H-alpha and magnetogram images. Transient preflare features were examined to develop an understanding of coronal flare precursors, especially what they tell us about changes in the local magnetic field. The results are as follows; Preflare X-ray enhancements were found in a statistically significant number of the preflare intervals searched, and consisted of one to three loops, kernels or sinuous features per interval. Typically, the preflare feature was not at the flare site and did not reach flare brightness. There was no systematically observed time within the preflare interval for the preflare events to appear, and, no correlation of preflare characteristics with the subsequent flare energy. Pressures of several preflare features were calculated to be on the order of a few dy/sq cm. H-alpha brightenings in the form of Knots and patches cospatial with or adjacent to the X-ray preflare features were found in nearly all of the intervals searched. Changing H-alpha absorption features were observed in about half of the cases, and took the form of surges or filament activations. The results do not provide support for loop preheating models, but do support models which require emerging flux as a means of activating larger coronal structures which flare.

34523 **(CEA-CONF—6877) Physics of ultra-high-density matter.** Soyeur, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1983. 43p. (In French). (CONF-8307120—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751572.

From Meeting on astrophysics and fundamentals interactions; Gargese, France (25 Jul 1983).

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This note deals with the study of the nuclear matter in two regions of the phase diagram: the low temperature-high baryon density region and the high temperature-low baryon density region. The specific subject of this work is to show the complementarity of the informations on the state of the nuclear matter in these regions obtained by the study of nuclei in laboratory or by observation of astrophysical phenomena in the good conditions of density and temperature. These phenomena are mainly: the gravitational collapses of massive stars, the evolution of neutron stars and the interaction of the very high energy cosmic rays with the nuclear emulsion chambers.

34524 **(DOE/ER/40048—82-L3) Identification of γ-ray lines observed from SS433.** Norman, E.B.; Bodansky, D. (Seattle Univ., WA (USA). Dept. of Physics; Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1983. Contract AC06-81ER40048. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013829.

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Lamb et al. recently have reported preliminary evidence for γ-ray line emission from the region of SS433. These authors have suggested that observed gamma-ray line features at 1.2 and 1.5 MeV may be the red- and blue-shifted components of the 1.369-MeV line from the first excited state to ground-state transition in

^{24}Mg. The purpose of this note is to point out some serious difficulties with this interpretation of the observed γ-ray lines.

34525 **(FERMILAB-CONF—84/40-T) Possible cosmological origin of the ultra high energy cosmic rays.** Hill, C.T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Apr 1984. Contract AC02-76CH03000. 6p. (CONF-840150—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013083.

From 4. Moriond workshop on massive neutrinos in particle and astro-physics; La Plagne, France (15 Jan 1984).

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Using improved spectrum evolution results for nucleons propagation through the 3°K microwave background we present a model of the UHE cosmic rays, above 10^{18} eV, assuming a universal cosmological component associated with bright phase activity and a semi-local component associated with the Virgo cluster. The results for the spectrum and anisotropy are in good agreement with the Haverah Park EAS observations. An unambiguous and potentially detectable electron neutrino spectrum is derived.

34526 **(FRNC-TH—1544) Contribution to the study of velocity fields of chromosphere and solar transition zone.** Artzner, C. (Paris-7 Univ., 75 (France)). Jun 1982. 262p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84751567.

The LPSP (Laboratoire de Physique Stellaire et Planetaire) experiment on board 0508 is described. The properties of the instrument are discussed together with their evolution with time. The chromospheric oscillations and transients were studied (sunspost and active regions, prominences, oscillations in the chromosphere, chromosphere-corona transition lines). Simultaneous time-resolved observations of the H Lα, Mg k 2795A, and Ca, K solar lines were made. They indicate that the temporal variations of wavelength of the reversal of the solar H Lα and Mg k lines are correlated. A narrow absorption on the red part of the solar H Lα profile was observed and attributed to atomic hydrogen of the nearby interplanetary gas.

34527 (INIS-BR—107, pp 100) **Narrow-band photometry of bright Be stars.** Claria, J.J.; Escosteguy, L.A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34528 (INIS-BR—107, pp 100-101) **BT monoceroties: An eclipsing nova.** Robinson, E.L.; Nather, R.E.; Kepler, S.O. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34529 (INIS-BR—107, pp 101) **Pulsation periods of the pulsating white dwarf G117-B15A.** Kepler, S.O.; Robinson, E.L.; Nather, R.E. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34530 (INIS-BR—107, pp 102) **DDO photometry of G and K stars.** Pastoriza, M.G.; Storchi, T.B.; Livi, S.H.B. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34531 (INIS-BR—107, pp 102-103) **Multicolor variations of the ZZ Ceti stars.** Robinson, E.L.; Kepler, S.O.; Nather, R.E. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34532 (INIS-BR—107, pp 103-104) **R crateris.** Livi, S.H.B.; Bergmann, T.S. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34533 (INIS-BR—107, pp 105-106) **Mean properties and metal abundances of the open clusters NGC 2232, NGC 2287 and NGC 2451.** Pastoriza, M.G.; Roepke, U.O. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34534 (INIS-BR—107, pp 107) **Open cluster melotte 227.** Bica, E.L.D.; Roepke, U.O. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34535 (INIS-BR—107, pp 107-108) **Measurements of the equivalent width of the Hβ emission line and age determination of HII regions of the LMC and SMC.** Dottori, H.; Bica, E.L.D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34536 (INIS-BR—107, pp 108) **Equivalent width of the Hβ emission line and the evolution of the HII regions.** Dottori, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34537 (INIS-BR—107, pp 109-110) **Rapid optical variation of the semiregular variable R Crt.** Livi, S.H.B.; Bergmann, T.S. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34538 (INIS-BR—107, pp 110) **Burst of star formation in detached extragalactic HII regions: A qualitative analysis.** Dottori, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34539 (INIS-BR—107, pp 115) **Standard stars for Hα photometry.** Strauss, F.M.; Ducati, J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34540 (INIS-BR—107, pp 97-99) **Surface photometry of southern galaxies.** Bergmann, T.S.; Pastoriza, M.G. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34541 (INIS-BR—107, pp 104) **DDO integrated photometry of globular clusters and initial chemical evolution of the galaxy.** Bica, E.L.D.; Pastoriza, M.G. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34542 (INIS-BR—107, pp 105) **Volumes of He^+ and H^+ zones in HII regions - The Orion nebula.** Copetti, M.V.F.; Bica, E.L.D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34543 (INIS-BR—107, pp 109) **DDO photometry and metallic abundances of E and SO galaxies and globular clusters of the LMC and SMC.** Dottori, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34544 (INIS-BR—107, pp 110) **Study of the nuclei of NGC 3732 and IC 4662.** Pastoriza, M.G.; Dottori, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34545 (INIS-BR—107, pp 111-114) **U.B.V. light variation in Seyfert galaxies.** Bisch, S.M.; Pastoriza, M.G.; Dottori, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34546 (INIS-BR—107, pp 115-116) **UBV variations in the nucleus of NGC 3347.** Dottori, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34547 (INIS-mf—8935, pp 39-42) **Pion condensation and neutron star dynamics.** Kaempfer, B. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Aug 1983. NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780275. (CONF-830674—).

From 6. international Balaton topical conference on high energy nuclear physics; Balatonfured, Hungary (6 Jun 1983).

The question of formation of pion condensate via a phase transition in nuclear matter, especially in the core of neutron stars is reviewed. The possible mechanisms and the theoretical restrictions of pion condensation are summarized. The effects of ultradense equation of state and density jumps on the possible condensation phase transition are investigated. The possibilities of observation of condensation process are described. (D.Gy.).

34548 (INIS-mf—8968, pp 127-131) **Role of $HC(OH)_2^+$ in interstellar molecular synthesis.** Villinger, H.; Saxer, A.; Lindinger, W. (Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik); Ferguson, E.E. (Paris-11 Univ., 91 - Orsay (France)); Bryant, H.C. (New Mexico Univ., Albuquerque (USA)). 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number TI84780269. (CONF-8308112—).

From 3. international Swarm seminar; Innsbruck, Austria (3 Aug 1983).

Recent measurements in different laboratories have established that the reaction of O_2^+ with CH_4 produces protonated formic acid $HC(OH)_2^+$ with a large rate constant at very low temperatures. The $HC(OH)_2^+$ ion so produced may be a significant contributor to interstellar formic acid, formaldehyde and formyl radical production by dissociative recombination with electrons. The exothermic reaction of CH_3^+ with O_2 to form protonated formaldehyde may also occur at cloud temperatures and be a source of formaldehyde or formyl radicals by dissociative electron recombination. Moreover ions produced in fast radiative association of $HC(OH)_2^+$ with neutrals such as H_2O may be the source of observed molecules as complex as methanol.

34549 **(LA-UR—84-1595) Model for GCR-particle fluxes in stony meteorites and production rates of cosmogenic nuclides.** Reedy, R.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 27p. (CONF-840385—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012435.

From 15. lunar and planetary science conference; Houston, TX, USA (12 Mar 1984).

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A model is presented for the differential fluxes of galactic-cosmic-ray (GCR) particles with energies above 1 MeV inside any spherical stony meteorite as a function of the meteorite's radius and the sample's depth. This model is based on the Reedy-Arnold equations for the energy-dependent fluxes of GCR particles in the moon and is an extension of flux parameters that were derived for several meteorites of various sizes. This flux is used to calculate the production rates of many cosmogenic nuclides as a function of radius and depth. The peak production rates for most nuclides made by the reactions of energetic GCR particles occur near the centers of meteorites with radii of 40 to 70 g cm^{-2}. Although the model has some limitations, it reproduces well the basic trends for the depth-dependent production of cosmogenic nuclides in stony meteorites of various radii. These production profiles agree fairly well with measurements of cosmogenic nuclides in meteorites. Some of these production profiles are different than those calculated by others. The chemical dependence of the production rates for several nuclides varies with size and depth. 25 references, 8 figures.

34550 **X-ray observations of a large sample of cataclysmic variable stars using the Einstein Observatory.** Cordova, F.A. (Los Alamos National Lab., NM); Mason, K.O. (Mullard Space Science Lab., Dorking, Great Britain). *Monthly Notices of the Royal Astronomical Society;* **206**: No. 4, 879-897(15 Feb 1984).

This paper presents the results of an X-ray survey of 31 known or suspected cataclysmic variables. Eighteen of these close binary systems are detected with infrared luminosities in the 0.1-4.0 keV band of between 10^{30} and 10^{33} erg s^{-1}. The majority have relatively hard X-ray spectra ($kT > 2$ keV) irrespective of luminosity state. Of seven dwarf novae observed during optical outbursts only U Gem exhibited enhanced ultrasoft X-ray emission (kT approx. 10 eV) in addition to weak, hard X-ray emission. Variability of the X-ray flux is observed in many of the stars, on time-scales ranging from tens of seconds to hours. The contribution to the flux from extended X-ray emission is investigated for SU UMa and GK Per.

34551 **Monopoles and bubbles in the early universe.** Steinhardt, P.J. (David Rittenhouse Laboratory University of Pennsylvania Philadelphia, PA 19104). pp 649-671 of Particles and fields. Capri, A.Z.; Kamal, A.N. New York, NY; Plenum Publishing Corp. (1983). (CONF-810882—). Contract AC02-76ER03071.

From 1981 Banff summer institute on particles and fields; Calgary, Alberta, Canada (16 Aug 1981).

This chapter reviews recent progress on 3 issues related to the description of first order phase transitions in field theories. Demonstrates how magnetic monopoles can act as impurity sites and mediate inhomogeneous first order phase transitions. Discusses the growth of bubbles nucleated in the decay process for the case of systems at non-zero temperature and density. Gives cases of field theories for which the semiclassical description of a first order

phase transition is inaccurate. Discusses applications to phase transitions in early cosmology. Examines monopole dissociation in the early universe; monopole and bubble growth in first order phase transitions; and the breakdown of the semiclassical approximation to bubble nucleation. Suggests that the modifications discussed or another modification yet to be discovered may lead to a more successful theory of the first order phase transitions that occurred in the history of the Universe and help to solve the cosmological mysteries that have hindered the present standard models.

34552 **Numerical calculations of gravity waves.** Wilson, J.R. (Lawrence Livermore National Laboratories, Livermore, CA 94550). pp 781-786 of Energy storage, compression, and switching. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—). Contract W-7405-ENG-48.

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter outlines some recent work to calculate gravitational radiation emission in some interesting, but simple, astronomical settings. It uses approximations that are involved in replacing differential equations with finite difference equations so that a solution may be found using a computer. It suggests that the low efficiency for the emission of gravitational radiation is due to the fact that when the system has contracted enough so that velocities are near the velocity of light then the system is near to being a black hole. The gravitational wave energy that is then formed has to climb out of a deep gravitational potential well and in so doing becomes very weak by the time it reaches a large distance ("gravitational red shift").

6402 Atmospheric Physics

34553 **(AD-A—137888/4) Study of low energy electron precipitations and auroral phenomena by using the USAF polar orbiting satellites. Final scientific report 1 Oct 78-30 Sep 83.** Meng, C.I. (Johns Hopkins Univ., Silver Spring, MD (USA). Applied Physics Lab.). Sep 1983. 55p. NTIS, PC A04/MF A01.

The main objective of this research project is to study the low energy electron precipitation and auroral phenomena over polar regions. The research is based on using various types of measurements from several USAF satellites at both low altitude polar orbits and high altitude geosynchronous orbits. These are focused on: (1) to investigate the different kinds of polar electron precipitations such as various auroral displays, the polar cusp region, conjugate photoelectrons, polar rain over the polar cap; (2) to determine precipitation characteristics for various kinds of magnetospheric and geophysical phenomena; (3) to investigate the physics and configuration of the polar cusp region and the polar cap region; and (4) to understand the morphology of magnetospheric particle population. The results of these studies can lead us to a better understanding of the interaction between the solar-wind and the geomagnetic field and also the coupling between the magnetosphere and the ionosphere.

34554 (INIS-BR—107, pp 91) **Excitation of whisher waves by reflected auroral electrons.** Wu, C.S. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology); Dillenburg, D.; Ziebell, L.F.; Freunol, H.P. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34555 **(LA—9998-MS) Transmission and reflection of laser beams propagating through aerosol clouds in space.** Zardecki, A.; Gerstl, S.A.W. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014146.

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We perform a parametric study to evaluate the shielding effectiveness of a cloud of carbonaceous and model aerosols in space against a collimated laser beam. Our modeling is generally based on the small-angle approximation to multiple scattering; for aerosols having a size distribution corresponding to inventory smokes, the diffusion theory is employed. Both the power delivered to the target and the reflected signal have been computed as a function of optical depth with the single-scattering albedo varied parametrically in the range from 0.1 to 0.99. This study establishes the importance of multiple-scattering effects when the single-scattering albedo is larger than 0.3. 22 references, 20 figures.

34556 **(LA-UR—84-430) Los Alamos Science, Number 10, Spring 1984.** (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84011404.

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The issue contains stories of three fascinating and novel explorations; first the exploration of a new idea in bioenergetics that may explain your body's remarkably efficient use of energy, second the exploration by satellite of the distant reaches of the earth's magnetosphere, and third, the exploration of surprising behavior in a tiny metallic crystal.

34557 (LA-UR—84-430, pp 32-57) **Journeys of a spacecraft.** Gosling, J.T.; Baker, D.N.; Hones, E.W. Jr. 1984. NTIS, PC A05/MF A01. Order Number TI84011404.

In Los Alamos Science, Number 10, Spring 1984.

With an assist from the moon, a spacecraft called ISEE-3 traveled far out along the nightside tail of our earth's magnetic field. There it discovered, among other things, huge ionic plasmoids breaking off from the earth's magnetosphere and hurtling out into space.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 33736

34558 **(CONF-8309252—1) Multiconfiguration wavefunctions for molecules: current approaches.** Dunning, T.H. Jr. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013422.

From NATO Advanced Research workshop on vectorization of advanced methods for molecular electronic structure; Colorado Springs, CO, USA (25 Sep 1983).

For problems such as dissociation or reactions of molecules, multiconfiguration wavefunctions (MCSCF) are required in order to obtain the electron correlation effects. Two general methods are available for specifying the orbitals and configurations for use in MCSCF calculations: the generalized valence bond and the fully optimized reaction space (FORS) method. The complete active space self-consistent field method is conceptually related to the FORS method. Calculations using the various methods are presented for HF and N_2.

34559 **(DOE/ER/40001—T3) Source for intense collimated beams of fast Cs^+ and Cs^0.** Wise, T.; Haeberli, W. (Wisconsin Univ., Madison (USA)). 08 Jun 1984. Contract AC02-81ER40001. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013270.

The characteristics of a surface-ionization source for Cs^+ of 20 to 55 keV energy are described. For applications requiring fast Cs^0 atoms, the Cs^+ beam is neutralized to 90% by passage through Cs vapor. The observed Cs^0 beam intensity through a 1.1 cm diameter aperture 78 cm from the ionizer is 10 particle-mA. 8 references, 10 figures.

34560 **(DOE/ER/45022—1) Electron hybridization effects and the crystal structure of plutonium. Progress report as of January 31, 1984.** Cooper, B.R. (West Virginia Univ., Morgantown (USA). Dept. of Physics). 1984. Contract AS05-83ER45022. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013642.

We have largely completed the technical development (including complex computer programming) necessary to carry out bulk LMTO electron energy band calculations. Such calculations will be used to include realistic band effects in our theory of crystallographic modifications of plutonium systems brought about through hybridization (mixing) between band electrons and relatively localized 5f electrons. In addition, we have developed and applied technique for including intermediate (between L-S and j-j) intraionic coupling on the plutonium ions. Treating such intermediate coupling is necessary for a fully quantitative treatment of the electron correlation effects on the ions. We have included such intermediate coupling and the possibility of long period structures to understand the magnetic behavior of PuSb. This demonstration of the importance of these two aspects of the behavior in hybridization mediated actinide systems is significant, because our hypothesis is that the low temperature crystallographic allotropes of plutonium (i.e., α, β, γ) are the crystal structure analogues of the long period magnetic structures found in cerium and light actinide monopnictides.

34561 **(DOE/ER/45039—1) Field ion microscopy and spectroscopy of hydrogen in metals. Progress report, August 1, 1983-March 1, 1984.** (Florida Univ., Gainesville (USA). Dept. of Materials Science and Engineering). 1984. Contract AS05-83ER45039. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012972.

Progress is reported on the double-tilt holder for TEM, new sample holder improved cryogenics for FIM, ion source for ion implantation, transient waveform digitizer, other computer interfacing, and preliminary calibration experiments. (GHT)

34562 **(FRNC-TH—1427) Study of post-collision effect on autoionisation electron spectra in He^+-He collision.** Ioannis, K. (Toulouse-3 Univ., 31 (France)). Nov 1981. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751582.

Energy spectra of electrons ejected by autoionisation of the helium atom have been measured at low collision energy (3-20 keV) in the He^+-He collision system. Perturbations of the line shapes due to the Coulomb field of the spectator ion are studied. Our results are compared with the semi classical model of MORGENSTERN et al. Only for small (or great) emission angles relative phases as well as moduli of transition amplitudes towards the Msub(L)=0 sublevel of the $2p^2\ ^1D$ and $2s2p\ ^1P$ states are deduced. Near the $2s^2\ ^1S$ line, strong discrepancies with the model are observed (at thetasub(Lab)=11°) which are attributed to a contribution of autoionisation in the quasimolecule. Angular distributions have also been measured which seem to be not perturbed by the Coulomb field. An unexplained oscillatory behaviour of the singly differential cross section, when plotted against the collision energy has also been observed.

34563 (INIS-BR—107, pp 41) **340 nm emission system in I_2 induced by a two-photon excitation process.** Grieneisen, H.-P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Laboratorio de Estudos Avancados); Francke, R.E. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34564 **(INIS-mf—8341) Determination of the mean energy needed for the creation of an ion pair for hydrogen- and helium ions in different gases with energy in the range 95-1110 keV.** Werba, T. (Frankfurt Univ. (Germany, F.R.). Fachbereich Physik). 9 Jan 1980. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780313.

As a result of the studies of N, CO_2 and CH_4, with decreasing energy of the primary ions a strong increase in the W-values has been found for He-ions. This increase is four times stronger as in the case of H-ions. For tissue equivalent gases the W-values can be determined from the different gas constituents by a mixing calculation. A special ionisation chamber set-up has been used for the present studies, including a monitoring system for the primary beam. (DG).

34565 **(LA-UR—84-1088) Metastable complexes of helium-hydrogen isotopes.** Taylor, R.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009995.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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We have found a long-lived, metastable, bound state between helium-3 and tritium. We report on a number of experiments designed to help characterize this complex found to be present in both liquid and solid T_2. We have measured a number of physical properties, such as vapor pressure, electrical conductivity, magnetic susceptibility, and ionic mobility as functions of composition, temperature, pressure, decay time, and physical state (liquid, solid, and/or gas). The production rate of ^3He from T_2 is only 0.93 percent per month; nevertheless, changes in a number of physical properties from that of the initial ^3He-free liquid can be observed.

34566 **(LBL—17670) Energy redistribution in diatomic molecules on surfaces.** Asscher, M.; Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 27p. (CONF-8404166—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84011442.

From 17. symposium on quantum chemistry and biochemistry: dynamics of molecule-surface interaction; Jerusalem, Israel (30 Apr 1984).

Translational and internal degrees of freedom of a scattered beam of NO molecules from a Pt(111) single crystal surface were measured as a function of scattering angle and crystal temperature in the range 450 to 1250K. None of the three degrees of freedom were found to fully accommodate to the crystal temperature, the translational degree being the most accommodated and the rotational degree of freedom the least. A precursor state model is suggested to account for the incomplete accommodation of translational and vibrational degrees of freedom as a function of crystal temperature and incident beam energy. The vibrational accommodation is further discussed in terms of a competition between desorption and vibrational excitation processes, thus providing valuable information on the interaction between vibrationally excited molecules and surfaces. Energy transfer into rotational degrees of freedom is qualitatively discussed.

34567 **(LBL—17822) Dynamic resonances in the reaction of fluorine atoms with hydrogen molecules.** Neumark, D.M.; Wodtke, A.M.; Robinson, G.N.; Hayden, C.C.; Lee, Y.T. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 18p. (CONF-840415—24). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013240.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

The reactions of F + H_2, HD and D_2 were studied in high resolution crossed molecular beams experiments. Center-of-mass translational energy and angular distributions were determined for each product vibrational state. In the F + H_2 reaction, the v = 3 product showed intense forward scattering while the v=2 product was backward-peaked. These results, in contrast to the backward scattering of all DF product vibrational states from F + D_2 at the same collision energy, suggest that dynamical resonances play an important role in the reaction dynamics of this system. In the F + HD reaction, the strong forward scattering of HF products and backward scattering of DF products is in agreement with the prediction of a stronger resonance effect for HF formation. The effect of the H_2 rotational excitation and the reactivity of F(^{2}P/sub 1/2/) are also discussed.

34568 **(N—8418322) Sputtering phenomena in ion thrusters. Final Report.** Robinson, R.S.; Rossnagel, S.M. (Colorado State Univ., Fort Collins (USA)). Feb 1983. 32p. (NASA-CR—168172). NTIS, PC A03/MF A01.

Sputtering effects in discharge chambers of ion thrusters are lifetime limiting in basically two ways: (1) ion bombardment of critical thruster components at energies sufficient to cause sputtering removes significant quantities of material enough to degrade operation through adverse dimensional changes or possibly lead to complete component failure, and (2) metals sputtered from these in-

tensely bombarded components are deposited in other locations as thin films and subsequently flake or peel off the flakes then lodge elsewhere in the discharge chamber with the possibility of providing conductive paths for short circuiting of thruster components such as the ion optics. This experimental work has concentrated in two areas. The first has been to operate thrusters for multi-hour periods and to observe and measure the films found inside the thruster. The second was to simulate the environment inside the discharge chamber of the thruster by means of a dual ion beam system. Here, films were sputter deposited in the presence of a second low energy bombarding beam to simulate film deposition on thruster interior surfaces that undergo simultaneous sputtering and deposition. Mo presents serious problems for use in a thruster as far as film deposition is concerned. Mo films were found to be in high stress, making them more likely to peel and flake.

34569 **(N—8419468) Ion extraction capabilities of two-grid accelerator systems.** Rovang, D.C.; Wilbur, P.J. (Colorado State Univ., Fort Collins (USA)). Feb 1984. 111p. (NASA-CR—174621). NTIS, PC A06/MF A01.

An experimental investigation into the ion extraction capabilities of two-grid accelerator systems common to electrostatic ion thrusters is described. This work resulted in a large body of experimental data which facilitates the selection of the accelerator system geometries and operating parameters necessary to maximize the extracted ion current. Results suggest that the impingement-limited perveance is not dramatically affected by reductions in screen hole diameter to 0.5 mm. Impingement-limited performance is shown to depend most strongly on grid separation distance, accelerator hole diameter ratio, the discharge-to-total accelerating voltage ratio, and the net-to-total accelerating voltage ratio. Results obtained at small grid separation ratios suggest a new grid operating condition where high beam current per hole levels are achieved at a specified net accelerating voltage. It is shown that this operating condition is realized at an optimum ratio of net-to-total accelerating voltage ratio which is typically quite high. The apparatus developed for this study is also shown to be well suited measuring the electron backstreaming and electrical breakdown characteristics of two-grid accelerator systems.

34570 **(ORNL—6052) 1982 bibliography of atomic and molecular processes.** Barnett, C.F.; Crandall, D.H.; Gilbody, H.B.; Gregory, D.C.; Kirkpatrick, M.I.; McDaniel, E.W.; McKnight, R.H.; Meyer, F.W.; Morgan, T.J.; Phaneuf, R.A. (comps.). (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 185p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013574.

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This annotated bibliography includes papers on atomic and molecular processes published during 1982. Sources include scientific journals, conference proceedings, and books. Each entry is designated by one or more of the 114 categories of atomic and molecular processes used by the Controlled Fusion Atomic Data Center, Oak Ridge National Laboratory to classify data. Also indicated is whether the work was experimental or theoretical, what energy range was covered, what reactants were investigated, and the country of origin of the first author. Following the bibliographical listing, the entries are indexed according to the categories and according to reactants within each subcategory.

34571 **(ORNL/TM—9032) Radiative decay of plasma oscillations on nonplanar metal surfaces.** Little, J.W.; Callcott, T.A.; Ferrell, T.L.; Arakawa, E.T. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013772.

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We have studied the radiation resulting from electron bombardment of extremely small silver particles and of silver films containing closely spaced, periodic surface structure. Thin silver films which were heated to a temperature slightly below the bulk-silver melting point were found to break into collections of particles with approximately ellipsoidal cross sections. Electron microscopy and shadow-casting techniques were used to characterize the samples as to the distributions of particle sizes and particle shapes. The wavelength, polarization, and angular intensity characteristics of the radiation emitted by these samples were compared with the predictions of a theoretical model for the radiative decay of surface plasmons on nonspherical particles. The results indicated that two distinct modes of charge density oscillation contributed to the radiation. Very closely spaced periodic surface modulations were produced in silver films by using the technique of electron beam lithography. Radiation resulting from the electron bombardment of these films showed evidence of structure that has been predicted theoretically. However, this structure was not well resolved. We have made suggestions which should be useful in future studies of the origin of this radiation. 100 references, 41 figures.

34572 **(SAND—83-1809) Angular correlation in Auger cascade coincidence measurements.** McGuire, E.J. (Sandia National Labs., Albuquerque, NM (USA)). May 1984. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013310.

It may be possible to measure a nonzero neutrino mass (of ~ 40 eV) by Auger cascade coincidence measurements (i.e., the M_1-$M_{4,5}N_{6,7}$-$(N_{6,7})^3$ cascade in Ho ($Z = 67$)), following nuclear capture of the 3s electron. The question arises, Are there detector locations that will enhance the (very low) counting rates. Expressions are obtained herein for the angular distribution of the two Auger cascade electrons, using both LSJ and jj coupling for the intermediate state. A simpler calculation, using Yb ($Z = 70$) (with an initially filled 4f subshell), jj coupling of the intermediate level, and a sum over final states, shows that the angular anisotropy is no more than 25% to 30%.

34573 **(SAND—84-0744C) Use of a tandem accelerator for light element analysis.** Arnold, G.W.; Doyle, B.L.; Bunker, B.C. (Sandia National Labs., Albuquerque, NM (USA)). 01 Jun 1984. Contract AC04-76DP00789. 17p. (CONF-8405191—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012551.

From International symposium on the nuclear accelerator impact in the interdisciplinary field; Padova, Italy (30 May 1984).

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The Sandia EN tandem Van de Graaff accelerator is being utilized to depth profile light elements (H, D, He, Li, B, C) in a variety of materials. It is particularly useful in glass studies; e.g., hydration, H/D exchange, alkali-ion depletion and crystallization in ion-implanted glasses. These investigations are primarily carried out by elastic recoil detection (ERD) in combination with Rutherford backscattering (RBS) and are discussed as illustrative examples.

34574 **(SAND—84-1082C) Highly sensitive high resolution Raman spectroscopy using resonant ionization methods.** Owyoung, A.; Esherick, P. (Sandia National Labs., Albuquerque, NM (USA)). May 1984. Contract AC04-76DP00789. 3p. (CONF-840868—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012240.

From 9. international conference on raman; Tokyo, Japan (26 Aug 1984).

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In recent years, the introduction of stimulated Raman methods has offered orders of magnitude improvement in spectral resolving power for gas phase Raman studies. Nevertheless, the inherent weakness of the Raman process suggests the need for significantly more sensitive techniques in Raman spectroscopy. In this we describe a new approach to this problem. Our new technique, which we call ionization-detected stimulated Raman spectroscopy (IDSRS), combines high-resolution SRS with highly-sensitive resonant laser ionization to achieve an increase in sensitivity of over three orders of magnitude. The excitation/detection process involves three sequential steps: (1) population of a vibrationally excited state via stimulated Raman pumping; (2) selective ionization of the vibrationally excited molecule with a tunable uv source; and (3) collection of the ionized species at biased electrodes where they are detected as current in an external circuit.

34575 Electron-electron correlation in highly charged atoms. Johnson, W.R.; Cheng, K.T. (Dept. of Physics Univ. of Notre Dame, Notre Dame, IN 46556). pp 463-488 of Quantum electrodynamics of strong fields. Greiner, W. New York, NY; Plenum Publishing Corp. (1983). (CONF-8106191—).

From NATO AST conference on quantum electrodynamics of strong fields; Lahnstein, F.R. Germany (15 Jun 1981).

The relativistic random-phase approximation (RRPA) is introduced to account for electron-electron correlation in atoms and ions of high nuclear charge where non-relativistic many-body methods are inadequate. To provide a basis for this study of the RRPA, the Dirac-Fock (DF) theory is reviewed. Applications of the DF equations to determine inner-electron binding energies in heavy atoms are given illustrating the influence of relativistic effects in situations where correlations are unimportant. The RRPA equations are derived as natural generalizations of the DF equations. Examples of RRPA calculations of discrete excitations and of photoionization are given illustrating situations where both relativistic and correlation effects play important roles.

34576 Coherence effects in heavy-ion-atom collisions. Bottcher, C. (Oak Ridge National Lab., TN). pp 403-411 of Coherence and correlation in atomic collisions. Kleinpoppen, H.; Williams, J.F. (eds.). New York, NY; Plenum Publishing Corp. (1980). Contract W-7405-ENG-26.

A new approach to charge capture and ionization by highly stripped projectiles is described and shown to explain cross-section systematics through the Periodic Table. Oscillations in cross section with respect to charge state observed around atomic number 70 are explained as an f-wave resonance in the target-electron-projectile scattering. The ratio of H_2 to H cross sections for both light and heavy projectiles is shown to fit a two-center coherent scattering model; independent scattering by the two centers is not a good assumption for velocities below 4 a.u. Similar coherence effects are predicted in stripping by molecular gases even in multielectron processes where the independent atom model might be thought valid. Recent experiments on the forward peak of electrons ejected from the projectile show interesting structure which can be partly explained without invoking interference effects.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 33615, 33864, 33880

34577 (CONF-840842—12) Coupling of Rayleigh-like waves with zero sound modes in normal ^{3}He. Bogacz, S.A.; Ketterson, J.B. (Argonne National Lab., IL (USA); Southern Illinois Univ., Carbondale (USA); Northwestern Univ., Evanston, IL (USA)). Mar 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010519.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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The damping of a wave of arbitrary ω and k traveling at an interface between normal ^{3}He and a solid is examined. It is found that the absorption spectrum contains singularities at the thresholds for the propagation of longitudinal and transverse zero sound as well as at the Fermi velocity.

34578 (INIS-mf—8921, pp 53) Perturbations in flows and some other effects as consequences of uncertainty relations. Temkin, A.Ya. (Tel Aviv Univ. (Israel). Dept. of Engineering Sciences). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

Published in summary form only.

34579 (INIS-SU—219, pp 210-215) Experimental study on the transient heat transfer when cooling with helium in different phase states. Dinaburg, L.B.; Senyuk, S.V.; Fokeev, F.F.; Shelounov, G.Ya. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

To optimize cooling of sUperconducting systems, the cooling capacity of helium in different phase states at quick rise and drop of load is experimentally studied. A resistance thermometer is placed on a textolite washer in a small copper bottle 10 mm in diameter and 100 mm long. The thermometer crystal of cubic form with a 1 mm edge is used in experiments as both a heater and a high-sensitive temperature sensor. The small copper bottle is suspended on a thin-walled stainless tube in the cryostat sink where the liquid helium temperature can be kept in the (4.22-1.85)K range. The obtained experimental data show that helium-2 cooling is most effective, the sensor is cooled down during less than 1 ms after ceasing the heating. It takes 10-15 ms to cool down the sensor in boiling helium-1. Supercritical and underheated heluium is least effective in cooling, since after 80 ms after ceasing the heating the sensor has not yet atained the initial temperature.

34580 (LA-UR—84-904) Maximum supercoolign in liquid ^{3}He-^{4}He mixtures near the tricritical point. Sinha, D.N.; Hoffer, J.K. (Rockwell International Corp., Anaheim, CA (USA); Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010076.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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Measurements of supercooling in liquid ^{3}He-^{4}He mixtures near the tricritical point are presented. The reduced temperature range $0.001 < \epsilon$ identical to $(1 - T/T/\text{sub } t/) < 0.01$ was investigated for three different rates of cooling using a pressure-quench technique. For $\epsilon < 0.012$, the maximum supercooling was found to be a function of the cooling rate. Comparisons with data in organic binary mixtures are given.

34581 (LA-UR—84-905) Dynamical scaling in ^{3}He-^{4}He liquid mixtures. Hoffer, J.K.; Sinha, D.N. (Los Alamos National Lab., NM (USA); Rockwell International Corp., Anaheim, CA (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010072.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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Light scattering data in decomposing ^{3}He-^{4}He mixtures yield the normalized dynamic structure factor anti S(k,t) and verify the dynamic scaling hypothesis anti $S(k,t) = k_1^{-3} F(k/k_1)$, where k_1 is the first moment of the (unnormalized) structure factor S(k,t), and F(x) is a time independent shape factor. Assuming that scaling is also valid for S(k,t), we trace the path of the quench in the temperature-composition plane.

34582 (LA-UR—84-944) Optical effects of the gravitationally induced concentration gradient in tricritical ^{3}He-^{4}He. Shiah, S.S.; Hoffer, J.K. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009972.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

Tricritical scaling is used to calculate the gravitationally induced concentration gradients (∂ x/∂ z)/sub T/ in near-tricritical mixtures of ^{3}He-^{4}He. It is shown that superfluid and normal fluid can coexist at temperatures above the tricritical temperature, separated by a point where (∂ x/∂ z)/sub T/ diverges weakly. Calculations of the refraction of light induced by (∂ x/∂ z)/sub T/ are presented that reveal the presence of a sharp kink in the refraction angle α, leading to the physical observation of an interface between coexisting normal and superfluid phases.

34583 (LA-UR—84-1020) Onset of oscillations in symmetric convective states in a superfluid ^{3}He-^{4}He mixture. Maeno, Y.; Haucke, H.; Ecke, R.; Wheatley, J.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009984.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

The oscillatory convective instability in a solution of 1.46% ^{3}He is studied in the Prandtl number range of 0.04 less than or approximately equal sigma less than or approximately equal 0.15. The observed behavior supports the theory of oscillatory convection for a classical, low-Prandtl-number, one-component fluid. A local temperature probe indicates a striking difference in the oscillatory amplitude when the sense of rotation of the convective rolls is reversed.

34584 (LA-UR—84-1052) Period-doubling two-torus state in a convecting ^{3}He-superfluid ^{4}He solution. Haucke, H.; Maeno, Y.; Wheatley, J.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-840842—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009985.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

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We present observations of the nonlinear dynamical behavior of a convecting dilute solution of ^{3}He in superfluid ^{4}He which approaches a chaotic state via a period-doubling sequence of one of two incommensurate frequencies.

6450 High Energy Physics

34585 (INIS-mf—8738) DESY annual report on scientific activities 1982. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). [nd]. 232p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780330.

This annual report contains a description of the organization of DESY, a list of international collaborations, short descriptions of the experiments at the storage rings PETRA and DORIS II, the muon scattering experiments at the CERN SPS, experiments with synchrotron radiation, and research in theoretical physics, descriptions of the status and developments of the accelerators and storage rings, a survey about the developments in data processing, and a list of publications and speeches.

34586 (INIS-mf—8935) Proceedings of the international conference on high energy nuclear physics held at Balatonfuered, 6-11 June 1983. Eroe, J. (ed.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Aug 1983. 603p. (CONF-830674—). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780275.

From 6. international Balaton topical conference on high energy nuclear physics; Balatonfured, Hungary (6 Jun 1983).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

34587 The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). 1104p. (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

The contents of this volume take the form of theoretical lectures, seminars on specialized topics, and review lectures. Individual subjects explored include the nonlocal U(2) gauge theory, SU(5) without SU(5), the electroweak program for the 1980s, the theoretical implications of Isabelle physics, the Bianchi-Backlund transformations, the Grand Unification, Planck energy and subnuclear physics, the link between pp and e^+e^- phenomena, the nonexistence of "molecular quark states," "oo" resonance, the status of e^+e^- physics in the United States, the e^+e^- PETRA machine, "deep inelastic" phenomena induced by charged leptons and those induced by neutrinos, the Orsay e^+e^- experiment in the "low"-energy range, the possible existence of more than one Z^0, the possible existence of baryon instability, the status of "charmed" particles, the "theoretical desert," and the heavy lepton and the consequences of its discovery for the frontiers of subnuclar physics.

34588 QCD, unifications, and the road to Asymptopia. Lindenbaum, S.J. (Brookhaven National Lab. Upton, NY 11973). pp 575-598 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—). Contract AC02-76CH00016.

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

The Road to Asymptopia--that energy beyond which no important new phenomena which are not predictable occur--is surveyed. The road leads from classical physics, to modern asymptotic theories, to the unifications, as shown. The conclusion that the world is a hierarchy of nested gauge groups is upset by the introduction of enormous numbers of Higgs', and is therefore premature. The Great Desert, with possible oases, is mapped out. It is advised to keep building next step accelerators as mini deserts followed by important oases are likely to be discovered all the way to the Planck length.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 33965, 34658

34589 (DESY—83-100) Search for new particles. Yamada, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 39p. (CONF-8308101—12). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751487.

From International symposium on lepton and photon interactions at high energies; Ithaca, NY, USA (4 Sep 1983).

The following topics are discussed briefly: Free quarks, Axions, Right-handed charged weak currents, Higgs particles, Top quarks, Generations -sequential heavy leptons, - exotic heavy leptons, - neutrino counting, - familons, Supersymmetric particles, Composite leptons, Magnetic monopoles. The experiments which are reviewed here employ two different methods. One way is to study a known process very precisely. Another way is to plan an experiment or choose analysis parameters in accordance with the predicted characteristics of the particle in order to remove the background. Usually the latter method is sensitive to a few events, but the former can lead to an unexpected surprise.

34590 (DESY—83-114) Properties of charm jets produced in e^+e^- annihilation near 34 GeV. Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Peise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751425.

Dsup(*+-) production via e^+e^- -> Dsup(*+-)X was studied at c.m. energies near 34 GeV. The charged particles produced in the hemisphere opposite to that of the Dsup(*) were used to investigate the fragmentation of charm jets. All spectra studied show a close similarity between the charm jet and the average jet obtained by summing over all quark flavours. The spectra of particles produced in the Dsup(*) hemisphere were used to study separately first rank and higher rank fragmentation.

34591 (DESY—83-115) Observation of hard processes in collisions of two quasi-real photons. Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Peise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751483.

Hard processes in photon-photon collisions are studied using high statistics data without requiring an electron tag. A high yield of hadrons with psub(t) in the range 1.5 to 3.0 GeV/c is observed. This yield exceeds the expectation of the Born term by a factor of four.

34592 (DESY—83-117) Recent results on e^+e^- annihilation from PETRA. Cords, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 16p. (CONF-8308131—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751481.

From 3. international conference on physics in collision; Como, Italy (31 Aug 1983).

Over the past year the energy of PETRA has been steadily increased in order to extend the search for the top quark. Neither topponium bound states nor a threshold for open top production has been found below a c.m. energy of 43 GeV. The implication of the measurement of R, the ratio of the hadronic to the point-like μ-pair cross section, on the determination of the strong coupling constant αsub(s) is discussed. The analysis of jets reveals, that the primary hadron fragments are heavy, that the fragmentation function of heavy quarks c and b is hard, and that gluons tend to have a wider transverse momentum distribution than quarks. The search for exotic particles is reported as negative for new heavy leptons, for scalars - like charged Higgs mesons or technipions - and for supersymmetric particles. Mass limits are given.

34593 (DESY—83-119) Observation of F meson production in high energy e^+e^- annihilation. Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Peise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751443.

Production of the F meson by e^+e^- annihilation at high energies has been observed in the phiπ final state with a mass of 1.975+-0.009+-0.010 GeV and a width consistent with the mass resolution. The yield of F production times branching ratio relative to μ pair production is Rsub(F)(x>=0.3)xB(Fsup(+-)->phiπsup(+-))"0.061+-0.012+-0.018.

34594 (DESY—83-121) Production and muonic decay of heavy quarks in e^+e^- annihilation at 34.5 GeV. Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Peise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G.; Schmitz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751485.

The production of prompt muons in e^+e^- annihilation has been studied at centre of mass energies near 34.5 GeV. The measured semi-muonic branching ratios of b and c quarks are B(b->X$\mu\nu$) = 0.117 +- 0.028 +- 0.01 and B(c->X$\mu\nu$) = 0.082 +- 0.012 sub(-0.01)sup(+0.02). The fragmentation functions of heavy quarks are hard, <zsub(b)> = 0.85 sub(-0.12)sup(+0.10) sub(-0.07)sup(+0.02) and <zsub(c)> = 0.77 sub(-0.07)sup(+0.05) sub(-0.11)sup(+0.03). Limits have been set on flavour changing neutral current decays: B(b->X$\mu^+\mu^-$)<0.02 and B(c->X$\mu^+\mu^-$)<0.007 (95% confidence level).

34595 (DESY—83-122) Exclusive production of hadron pairs at large momentum transfer in photon-photon interactions. Berger, C.; Deuter, A.; Genzel, H.; Lackas, W.; Pielorz, J.; Raupach, F.; Wagner, W.; Klovning, A.; Lillestoel, E.; Olsen, J.M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751484.

We report on the exclusive production of π, K and proton pairs from photon-photon interactions at momentum transfers vertical stroketvertical stroke >= 1 GeV^2. Using the PLUTO detector at the e^+e^- storage ring PETRA, we have observed 15 events in an integrated luminosity of 41.7 pb^{-1}. The data lie far below the expectations for point-like hadrons, and are in reasonable agreement with the QCD-based predictions of Brodsky and Lepage.

34596 (DESY-L-Trans—285) Perturbative corrections to sigma sub(tot) (e^+e^- -> hadrons) in supersymmetric QCD. Kataev, A.L.; Pivovarov, A.A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751490.

Translated from Russian.

sigmasub(tot) (e^+e^- -> γsup(*) -> hadrons) have been calculated in QCD at two-loop level. Three-loop corrections due to gluon pair production are quoted accompanied by quark-antiquark two-jet events.

34597 (DOE/ER/03130—20) Progress report of a research program in experimental high energy physics. Progress report, January 1, 1984-December 31, 1984. Lanou, R.E. Jr. (Brown Univ., Providence, RI (USA)). 15 Jun 1984. Contract AC02-76ER03130. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013553.

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An experimental program in strong and electro-weak interaction physics of elementary particles is being carried out using electronic detection techniques. Experiments have been performed or are being prepared utilizing the accelerators of the laboratories at Brookhaven and Fermilab. The experiments described in this report by the Electronic Detector Group include the following: (1) experiments to measure neutrino-electron scattering and other neutral current phenomena, (2) preparations for experiments at the FNAL anti P P Collider, (3) neutrino oscillation experiments at BNL, and (4) a monopole search.

34598 (DOE/ER/40125—1) Indiana University High Energy Physics Group technical progress report, November 1, 1983-November 30, 1984. Ahlen, S.P.; Brabson, B.B.; Crittenden, R.R.; Dzierba, A.R.; Heinz, R.M.; Martin, H.J. Ogren, H.O. (Indiana Univ., Bloomington (USA). Dept. of Physics). 1984. Contract AC02-84ER40125. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012688.

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The Indiana University High Energy Physics Group has been actively involved in a variety of research programs during the current contract period. These programs are associated with major experiments conducted by our group at SLAC, Fermilab, and Brookhaven. The physics areas under investigation include studies of e^+e^- interactions at high energy at SLAC (PEP HRS experiment), jet and dimuon production utilizing the Multiparticle Spectrometer at Fermilab (E110/E557/672), and glueballs (Brookhaven E771). The status of these efforts are discussed.

34599 (FERMILAB-Conf—84/49-T) Transverse momentum distributions of jets and weak bosons. Ellis, R.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). May 1984. Contract AC02-76CH03000. 10p. (CONF-8403130—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013081.

From 4. topical workshop on proton antiproton collider physics; Bern, Switzerland (5 Mar 1984).

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The theoretical description of processes leading to events at large transverse momentum is reviewed. Numerical estimates are given for jet cross-sections and for W and Z production cross-sections. The influence which uncertainties in the input parameters have on the theoretical predictions is also discussed.

34600 (INIS-mf—8735) High energy photon-photon scattering in 2-photon processes and test of quantum electrodynamics. Sakurayama, Y. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 31 Jan 1983. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780276.

For the test of the electron propagator of quantum electrodynamics at high energies and large momentum transfer the electron-positron scattering with production of two high energy photons is suited. The reaction e^+e^-->$e^+e^-\gamma\gamma$ contains in the lowest perturbation theoretical order the radiation of two bremsstrahlung quanta as well in higher order the production of two γ-quanta by internal photon-photon scattering processes. For the test of quantum electrodynamics expecially this photon-photon scattering contribution is of interest. In the present thesis this part was calculated and compared with the bremsstrahlung contribution. Thereby among other the already known scattering amplitude of two virtual photons had to be mode accessible for the numerical evaluation by elimination of all apparent singularities. The calculated photon-

photon scattering contribution was compactly formulated by use of all symmetry properties. For the control of the exact calculation also approximation formulae of the main parts of the photon-photon scattering contribution as well the bremsstrahlung contribution were developed. The discussion of the results showed that by the measurement of the reaction $e^+e^-\to e^+e^-\gamma\gamma$ with an accuracy of 10% at a photon energy of 1 GeV a test of the electron propagator is reachable up to a length of about 0.2×10^{-13}cm. Thereby also the influence of the vacuum polarization by μsup(+-), πsup(+-) and psup(+-) was regarded. (orig./HSI).

34601 **(INIS-mf—8750) Semi-inclusive hadron production in the deep inelastic μp scattering. Results of experiments of the European Muon Collaboration.** Becks, K.H. (Wuppertal Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 8 - Naturwissenschaften 1 - Physik). 1982. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780332.

Results on semi-inclusive hadron production of the μp scattering experiment of the European Muon Collaboration are presented. The gross features of the longitudinal properties of the observed final state mesons are well described by the Quark Parton Model predictions. Comparing the high energy data of this experiment with low energy data, no strong energy dependence is found. The predicted charge asymmetry of charged mesons at high x and z is seen in the data. The production rate of neutral pions equals the half sum of charged pions. The fragmentation process of quarks into mesons seems to be process independent (environmental independence). A possibel explanation of the observed high baryon rate (10% to 15% of all charged hadrons) in the current direction at high center of mass energies W is the diquark pair production in the fragmetnation cascade. Because of the observed Q^2 dependence, higher twist effects cannot be the main source of the observed proton and antiproton signal in the measured kinematical range. For high W and high Q^2 first evidence is found for scaling violations and factorization breaking of the fragmentation functions. The observed pattern of the data is consistent with beyond-to-leading order QCD calculations. A quantitative description of the transverse properties of the final hadrons and the observed jet structure at high W can only be obtained by including the increase of the transverse momentum due to hard gluon emission.

34602 (INIS-mf—8935, pp 73-101) **Colour exchange of high energy hadrons in nuclei.** Kopeliovich, B.Z.; Lapidus, L.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). Aug 1983. NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780275. (CONF-830674—).

From 6. international Balaton topical conference on high energy nuclear physics; Balatonfured, Hungary (6 Jun 1983).

It is very difficult to investigate experimentally the basic process of hadron-nucleo.n interactions, described by quantum chromodynamics, because of the macroscopic distance of detectors from the reaction volume and because of the fast hadronization process. To detect the primary color-exchange process it is necessary to use two targets displaced away from each other to a distance of the order 1 fm, i.e. inside a nucleus. Thus the hadron-nucleus reactions at high energy represent a laboratory for the investigation of color dynamics of the hadronic interactions. Some theoretical problems, e.g. diffractive hadron-nucleus scattering, multiple color exchange, multiparticle production and effects of quark confinement on color exchange reactions are surveyed. Suggested methods for evaluation of experimental data of hadron-nucleus collisions are described. (author).

34603 **(KFK—3643) Semileptonic decays of c and b quarks.** Schneider, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Dec 1983. 24p. (CONF-830718—26). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751448.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

Recent results on the semileptonic branching ratios of c and b quarks are reviewed. Mainly the high energy data from PEP at $\sqrt{s}$ proportional 29 GeV and PETRA at $\sqrt{s}$ proportional 34 GeV are presented. The influence of the parton fragmentation into hadrons is discussed.

34604 **(LBL—17806) Recent results from the PEP-4 TPC.** Madaras, R.J. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 33p. (CONF-8403121—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013241.

From New particle production at high energy meeting: The Recontre de Moriond; La Plagne, France (4 Mar 1984).

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Presented are the latest results from the PEP-4 TPC on inclusive charged and neutral particle production, resonance production, heavy quark fragmentation and flavor correlations. 27 references.

34605 **(LBL—17845) Hadron production in e^+e^- annihilation at PEP.** Hofmann, W. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 30p. (CONF-8404163—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013236.

From 6. international conference on high energy physics; Nashville, TN, USA (5 Apr 1984).

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Recent results from PEP on quark and gluon fragmentation are reviewed. Topics include: inclusive stable particle production and resonance production, particle distributions in jets, heavy quark fragmentation, flavor correlation studies and tests of fragmentation models. 37 references.

34606 **Multiparticle hadronic systems produced in high-energy (pp) interactions, and comparison with (e+e-).** Basile, M.; Cifarelli, L.; Contin, A.; D'Alf, G.; Esposito, B.; Giusti, P.; Massam, T.; Nania, R.; Palmonari, F.; Romeo, C.C. (CERN, Geneva). pp 495-507 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

The similarity between the inclusive fractional momentum distribution of the particles produced in (e+,e-) annihilation and hadronic systems produced in (pp) interactions is established by subtracting "leading" proton effects. The use of leading hadron effect (a general phenomenon in all hadron physics) in (pp) interactions has brought a vast amount of low-pT physics into the domain of comparison with (e+,e-) physics. Inclusive fractional momentum distribution, inclusive transverse momentum distribution, average charged particle multiplicity, the ratio of charged to total energy, and planarity, are compared in this paper. The old belief that only high -pT phenomena could be compared to (e+e-) physics seems to be over.

34607 **Theoretical implications of ISABELLE physics.** Chau, L.L. (Physics Dept. Brookhaven National Lab. Upton, NY 11973). pp 447-493 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

This paper updates the analysis of a proton-proton colliding storage ring in the context of ISABELLE physics. Z^0, W + or - will be produced plentifully at ISABELLE. The production of intermediate bosons will serve as a factory of heavy quark states. Onia of mass up to 120 GeV are detectable at ISABELLE. The Higgs boson can be searched by observing the bump signature in the dilepton invariant mass from its bremsstrahlung off the Z^0. New sources of gluon-gluon interactions will produce Higgs bosons, and technicolor pseudo scalars. But new complex triggering systems besides the dilepton detection will be necessary to detect these new particles. A brief historical review of ISABELLE is also included.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 34116, 34631, 34642, 34723, 34724, 34738, 34739, 34740, 34741, 34742

34608 **(BNL—34728) Electroweak interaction parameters.** Marciano, W.J. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 17p. (CONF-8403130—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012910.

From 4. topical workshop on proton antiproton collider physics; Bern, Switzerland (5 Mar 1984).

The parameters discussed include: the renormalized weak mixing angle, masses and widths of the W plus and minus and of the Z boson, radiative Z and W boson decays. The Higgs-top quark mass connection and the Grand Unification theories are briefly reviewed. It is suggested that a new pseudoscalar particle with a mass near 93 GeV could be produced by gluon-gluon fusion. 28 references. (LEW)

34609 **(CNRS-CPT—82-P-1414) Comment on QCD sum rules and weak bottom decays.** Guberina, B.; Machet, B. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jul 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751554.

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QCD sum rules derived by Bourrely et al. are applied to B-decays to get a lower and an upper bound for the decay rate. The sum rules are shown to be essentially controlled by the large mass scales involved in the process. These bounds combined with the experimental value of BR ($B \to e\nu X$) provide an upper bound for the lifetime of the B^+ meson. A comparison is made with D-meson decays.

34610 **(DOE/ER/70004—369) Relation of parton distribution functions in Drell-Yan process to deeply inelastic scattering.** Collins, J.C.; Soper, D.E.; Sterman, G. (Illinois Inst. of Tech., Chicago (USA). Dept. of Physics; Oregon Univ., Eugene (USA). Inst. of Theoretical Science; State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics). Apr 1983. Contract AT06-76ER70004. 6p. (OITS—209). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013832.

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We consider certain parton distribution functions P(x,k/sub T/) that appear in a proposed form of factorization for the Drell-Yan process at measured Q/sub T/. We argue that these Drell-Yan parton distribution functions P/sub q/A/(x, k/sub T/) are related by a light cone expansion to the distribution functions f/sub q/A/(x) measured in deeply inelastic lepton scattering. 12 references.

34611 **(FRNC-TH—1404) Experiments on multiparton final states in e^+e^- annihilation at $\sqrt{s}$=30 GeV (MARK-J/PETRA).** Hariri, S. (Grenoble-1 Univ., 38 (France)). Mar 1982. 254p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84751581.

This work is devoted to an experimental study of the quantum chromodynamics (Q.C.D.) matrix element. The first chapter consists of a general introduction, theoretical and phenomenological. In the second chapter, we give an elementary description of the detector. In addition to the topological methods given there, the third chapter contains a presentation of the MULTIJET analysis especially designed to study Q.C.D. matrix element. The fourth chapter begins with an application to MARK J data of the topological analysis described in the third chapter. Since the detector is a calorimeter, the transformation of particles into pseudo-particles introduces an additional effect which adds to hadronization effects. The BantiB model is a restriction of the quark model to the production of b quarks. The comparison of this model to the data shows that such a purely hadronic model is able to reproduce the experimentally observed rate of events called three jets. Nevertheless, the matrix element, corresponding to the BantiB model three jet events, is completely excluded by the data. The same statement applies to the quark model with wide hadronization. The fact that the data favours clearly Q.C.D. predictions is shown for differents values of (epsilon, delta) and for different variables (Nsub(J), Tsub(J), σsub(3J). In the fifth chapter our Q.C.D. model with 2 and 3 jets is precisely defined. The systematical errors, experimental and theoretical are given in this chapter. Since the number of active flavours can affect our results, the exclusions of an open production of a sixth flavour with +-2/3 or +-1/3 is given there and an upper limit on the possible rate of 4 jet events is defined. The obtained results being in full agreement with our (2 and 3)-jet Q.C.D. model, the rapid convergence of the perturbative series at $\sqrt{s}$=30 GeV is confirmed once more.

34612 (INIS-BR—107, pp 55) **Mean-field approach to Λ and Σ hypernuclei.** Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34613 (INIS-BR—107, pp 58-59) **Structure of Σ-hypernuclei.** Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34614 (INIS-BR—107, pp 59) **Structure of Σ-hypernuclei.** Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34615 (INIS-BR—107, pp 60) **Widths of Σ-hypernuclear states.** Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34616 (INIS-BR—107, pp 62) **Study of dihyperon production.** Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34617 (INIS-BR—107, pp 60-61) **Single particle energy relativistic estimation sub(Σ) ^{16}O hypernucleus.** Thomas, G.L.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34618 (INIS-BR—107, pp 61) **Mean field of Σ-hypernuclei.** Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34619 (INIS-mf—8953) Separable representation of the proton-proton interaction. Schweiger, W. (Graz Univ. (Austria)). 1982. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780331.

For the p-p system reliable experimental phase shifts and low energy parameters are available. Comparison with theory is complicated by corrections from the long-range Coulomb potential. Previous separable potentials failed to reproduce the experimental data. Therefore a new separable potential is introduced which 1) gives a correct account of the p-p system in the partial waves l<-2 and 2) allows an analytical treatment of the Coulomb distortion. With this potential calculated values for the partial wave l<-2 phase and the effective range L<-2 are given and compared with experimental data and the old Gray potential. Assuming charge symmetry predictions concerning the n-n system are made. General properties of the off-shell T-matrix of Coulomb-like potentials and possible consequences are investigated. Finally the influence of Coulomb distortion on the nuclear part of the half-shell T-matrix is discussed qualitatively.

34620 (LAL—83-26) Electron-positron scattering and gauge theories. Davier, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1983. 28p. (CONF-8305195—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751564.

From Meeting on phenomenology of modern unified field theories from standard model to supersymmetries; Dubrovnik, Yugoslavia (22 May 1983).

Portions are illegible in microfiche products.

Recent results from high-energy e^+e^- colliding facilities are reviewed in the context of gauge theories. First QCD analyses are discussed and difficulties are seen to arise from the interplay between perturbative QCD and non-perturbative fragmentation processes. Many results have been recently obtained on weak electromagnetic interference, strengthening our faith in the standard SU(2) x U(1) theory: however some pieces are still missing and looked for. Finally, vigourous searches are pursued to find clues for physics beyond the SU(3) x SU(2) x U(1) framework: among those supersymmetric particles are being actively hunted in a large variety of situations.

34621 (MPI-PAE/Exp.El.—120) Introduction to neutrino oscillations and neutrino masses. Schmitz, N. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Aug 1983. 82p. (CONF-8309219—2). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751424.

From International school of elementary particle physics; Kupari, Yugoslavia (18 Sep 1983).

In these lectures we first summarize the general formalism of neutrino oscillations and treat the cases of two and three neutrino flavors in more detail. We then discuss some general experimental and numerical aspects and give a survey of the various types of experiments to look for neutrino oscillations. We describe the searches for oscillations carried out so far and present the experimental results. Finally we discuss the methods to determine the neutrino masses directly and give the present upper limits on these masses.

34622 Hadronic physics of qq^- light quark mesons, quark molecules and glueballs. Lindenbaum, S.J. (Brookhaven National Lab. Upton, NY 11973). pp 509-574 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—). Contract AC02-76CH00016.

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

The status of model classifications for conventional u, d, and s, quark meson states is reviewed. Evidence for narrow (mock) baryonium was contradicted in BNL Multiparticle Spectrometer experiments. Nor was any convincing evidence for wide (true) baryonium discovered. But Jaffe's low energy qqqq states have been made more plausible by the P-matrix treatment. Glueballs, and how to find them, are also discussed. The failure of the OZI rule in pi$^-$p psi-psi n is explained. Precision studies of low energy hadron spectroscopy are recommended.

34623 Why most flavor dependence predictions for nonleptonic charm decays are wrong. Lipkin, H.J. (Fermi National Accelerator Lab. Batavia, IL 60510). pp 389-413 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

Nonleptonic weak decays of strange hadrons are complicated by the interplay of weak and strong interactions. The discovery of charmed particles with open channels for nonleptonic decays has lead to new understanding of decays. Final state interactions by a full dynamical calculation, including enhancement factors and couplings to inelastic channels, must be taken into account. Since these calculations are not possible at present, two alternative approaches--phenomenological models, and the use of subgroups--are suggested. Related symmetry breaking mechanisms are also discussed. The approach is then generalized to the use of larger flavor symmetry groups, and the interplay between different types of flavor symmetry is seen.

34624 Exotic multiquark states with charm. Lipkin, H.J. (Fermi National Accelerator Lab. Batavia, IL 60510). pp 599-625 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

Suggestions that quarks and leptons are not elementary but made of more fundamental objects called rishons and preons is discussed. A rishon model, and the Han-Nambu cube, is studied. The possible existence of multiquark states is studied. Diproton, and dipon are rejected, but the "threshold exotics," dikaon, baryon B, and anticharmed D meson, which would give unambiguous signatures for a multiquark hadron, are studied. The MIT bag model, and a quasinuclear colored quark model, are rejected in favor of a naive quark model. The success of the model with n=2 and n=3 systems leads to its application with n=4 multiquark systems.

34625 Deep inelastic phenomena. Prescott, C.Y. (Stanford Linear Accelerator Center Stanford Univ., Stanford, CA 94305). pp 677-733 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—). Contract AC03-76SF00515.

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

This paper reviews and brings up to date the picture of nucleon structure as seen in the context of inelastic scattering. The quark-parton model, which forms the basis of understanding of lepton-nucleon inelastic scatterings, is studied. A new theory of strong interactions, quantum chromodynamics, was developed, when the quark-parton model began to fail. Basic couplings of QCD are studied. Burras and Gaemers' analysis indicates that leading order QCD provides a good description of eN, muN, and vN inelastic scattering. Moments of the structure function, and the parameter R are also examined. Finally, current experiments in the field-the CHIO, European Muon, BCDMS, and BFP collaborations--are all reviewed in detail.

34626 Double beta decay and majorana neutrinos. Right-handed currents or nonzero masses?. Rosen, S.P.; Perlmutter, A. (Purdue Univ., West Lafayette, IN 47907). pp 333-347 of Gauge theories, massive neutrinos, and proton decay. Kursunoglu, B. New York, NY; Plenum Publishing Corp. (1981). (CONF-810134—).

From Orbis scientiae conference; Fort Lauderdale, FL, USA (19 Jan 1981).

This chapter describes some new developments concerning the mechanism for lepton number nonconservation in no-neutrino double beta decay. Explains that lepton number nonconservation in no-neutrino double beta decay comes about either because both left- and right-handed components of a Majorano neutrino are coupled to the electron in the weak leptonic current, or because the neutrino has nonzero mass. Shows that while nuclear ground-state to ground-state transitions arise from right-handed currents and from neutrino mass terms, transitions to low-lying excited states with J /SUP P/ $=2^+$ can arise only from right-handed currents. Emphasizes that the possibilities of detecting small admixtures of

right-handed currents, and of setting limits on neutrino masses that are either very small or very large, make double beta decay a most rewarding phenomenon to study.

6453 Particle Invariance Principles And Symmetries

34627 (CNRS-CPT—83-P-1499) Analysis of instanton contribution for the periodic CP_1-model. Richard, J.L. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Apr 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751555.

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The analysis of the instanton contribution for the CP_1-model with periodic boundary conditions is performed using isospin invariance. An interpretation in terms of a neutral Coulomb gas is given.

34628 (CONF-840275—10) Forward-backward asymmetries in W and Z decays. Rosner, J.L.; Langacker, P.; Robinett, R.W. (Chicago Univ., IL (USA). Dept. of Physics; Pennsylvania Univ., Philadelphia (USA). Dept. of Physics; Institute for Advanced Study, Princeton, NJ (USA); Massachusetts Univ., Amherst (USA). Dept. of Physics). 13 Feb 1984. Contract AC02-76CH03000. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013481.

From Workshop on anti pp options for the SSC; Chicago, IL, USA (13 Feb 1984).

The leptons emitted in decays of W and Z bosons produced in pp or anti pp collisions exhibit characteristic asymmetries with respect to the beam direction, as measured in the W or Z center-of-mass. The asymmetries appear in both pp and anti pp collisions. For anti pp collisions they appear to be approximately constant over the whole y range for values of $M/\sqrt{s} \geqq 0.1$. For smaller values of $M/\sqrt{s}$, the asymmetries become more and more washed out in the central region as sea-sea collisions begin to play a larger role in gauge boson formation.

6454 Field Theory

REFER ALSO TO CITATION(S) 34600

34629 (ANL-HEP-CP—84-21) Weak coupling tests of lattice QCD. Kovacs, E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. (CONF-8404119—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013440.

From Workshop on gauge theory on a lattice; Argonne, IL, USA (5 Apr 1984).

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For many arbitrary lattices with arbitrary SU(N) actions, the perturbative value of Λ/sub latt//Λ/sub MOM/ can be estimated from the Monte Carlo data at weak coupling by analyzing the perturbative expansions for various Wilson loop ratios. Here, general loop ratios including those of polygons and parallelograms are considered. The lowest order perturbative expansions are calculated and some applications to the Monte Carlo data are presented.

34630 (BONN-HE—83-23) Rubakov effect. Nahm, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Nov 1983. 13p. (CONF-8310265—4). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751433.

From International symposium on the theory of elementary particles; Ahrenshoop, German D.R. (9 Oct 1983).

The author presents an introduction to the catalysis of baryon number violating processes in grand unified theories by the fields of magnetic monopoles.

34631 (CEA-CONF—7049) Quantum chromodynamics, chiral symmetry and bag models. Soyeur, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1983. 53p. (CONF-8308160—2). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751559.

From International school of intermediate energy nuclear physics; San Miniato, Italy (19 Aug 1983).

This course deals with the following subjects: quarks; quantum chromodynamics (the classical Lagrangian of QCD, quark masses, the classical equations of motion of QCD, general properties, lattices); chiral symmetry (massless free Dirac theory, realizations, the σ-model); the M.I.T. bag model (basic assumptions and equations of motion, spherical cavity approximation, properties of hadrons); the chiral bag models (basic assumptions, the cloudy bag model, the little bag model); non-topological soliton bag models.

34632 (CNRS-CPT—83-P-1500) Behavior of the Wilson parameter in U(1) lattice gauge theory with long range gauge invariant interactions. Ruiz, J. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Apr 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751556.

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The U(1) lattice gauge model with fermions can be expressed after integration over the fermionic variables as a "long range gauge model": the effective action is a sum over all possible gauge field loops with corresponding weight factors. Different behaviors of the Wilson parameter are shown according to the hypothesis on the weight factors.

34633 (DESY—83-106) Restoration of Lorentz invariance in SU(2) and SU(3) lattice gauge theories. Teper, M.; Schierholz, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1983. 11p. (LAPP-TH—89). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751428.

We calculate the energy-momentum dispersion relation for the Osup(+(+)) glueball in SU(2) and SU(3) lattice gauge theories. We find that this relation takes the usual relativistic continuum form $E^2 = psup(->2) + m^2$ for $\beta >= 2.2$ in the case of SU(2) and $\beta >= 5.5$ in the case of SU(3), thus demonstrating the dynamical restoration of Lorentz invariance. We obtain similar results, albeit with larger statistical errors, for the 2^{++} glueball.

34634 (DESY—83-112) Scaling of the quark-antiquark potential and improved actions in SU(2) lattice gauge theory. Montvay, I.; Gutbrod, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751427.

The scaling behaviour of the quark-antiquark potential is investigated by a high statistics Monte Carlo calculation in SU(2) lattice gauge theory. Besides the standard one-plaquette action we also use Symanzik's tree-level improved action and Wilson's block-spin improved action. No significant differences between Symanzik's action and the standard action have been observed. For small β Wilson's action scales differently. The string tension value chi extracted from the data corresponds to Asub(latt) = (0.018 +- 0.001) √chi for the one-plaquette action.

34635 (DESY—83-113) Variational determination of the string tension and the glueball mass in (2+1) dimensional U(1) lattice gauge theory for all values of the coupling constant. Langguth, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751426.

Using variational ansaetze of the product type we calculate the massgap and the stringtension of (2+1) dimensional U(1) lattice gauge theory in the Hamiltonian formalism for all values of the coupling constant. In the strong coupling limit our results agree with high order strong coupling series. In the weak coupling limit both, glueball mass and stringtension vanish exponentially with the coupling constant.

34636 (DESY—83-120) Monte Carlo simulations with Symanzik improved actions. Berg, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 25p. (CONF-8310265—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751486.

From International symposium on the theory of elementary particles; Ahrenshoop, German D.R. (9 Oct 1983).

I summarize Monte Carlo results, which were recently obtained using Symanzik improved actions.

34637 **(DOE/ER/02978—11) Inelastic strong interactions at high energies. Final report, June 1, 1976-May 31, 1984.** Suranyi, P. (Cincinnati Univ., OH (USA)). 1984. Contract AC02-76ER02978. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013647.

Work in Reggeon Field Theory is described. Multiparticle processes were studied. Cut RFT's were examined and convergence of perturbation expansions was considered. An RFT with an internal symmetry was also investigated. We made a study of model independent predictions for various high energy cross-sections, introducing the concept of sections. We examined the quantum mechanics of polynomial potentials as a model for quantum field theories. We determined various convergence properties of approximate calculational methods. Various aspects of GUT's were studied. The Higgs sector was examined and various symmetry breaking patterns were found using different representations for the Higgs. Bounds were put on parameters of the theory at finite temperature. Lattice gauge theories were studied. We looked at one exactly soluble one-dimensional model, and then began an extended investigation of Hamiltonian Lattice gauge theories. We studied the weak coupling behavior of global and local abelian lattice gauge theories in arbitrary dimensions, using various periodic trial functions and the WKB approximation. Supersymmetry and supergravity were investigated. We examine the compatibility of scale transformations in super space and the properties of scale invarient theories in ordinary spacetime. We discovered the largest possible local linear symmetry which is allowed given the structure of spacetime. We developed a systematic method for performing dimensional reduction on theories which admit abelian killing vectors. 68 references.

34638 **(FERMILAB-Conf—84/41-T) Perturbative corrections to university and renormalization group behaviour.** Ellis, R.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Apr 1984. Contract AC02-76CH03000. 11p. (CONF-8404119—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012702.

From Workshop on gauge theory on a lattice; Argonne, IL, USA (5 Apr 1984).

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The influence of weak coupling corrections on tests of the universality of lattice actions is discussed. The two loop corrections described in this paper were performed using the background field method. An estimate is also provided of the perturbative corrections to asymptotic scaling for the Wilson action. Monte Carlo simulation of Lattice QCD is carried out at finite, large values of the bare coupling g, but the continuum limit of the theory corresponds to vanishing g. When extracting physical results from lattice calculations it is therefore important to correct for the non-zero value of the coupling constant. The results of some perturbative calculations are reported, which address this question.

34639 **(FERMILAB-Conf—84/48-T) Monte Carlo renormalization group calculations for SU(2) lattice gauge theory.** Mackenzie, P.B. (Fermi National Accelerator Lab., Batavia, IL (USA)). Apr 1984. Contract AC02-76CH03000. 9p. (CONF-8404119—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013082.

From Workshop on gauge theory on a lattice; Argonne, IL, USA (5 Apr 1984).

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A Monte Carlo renormalization group calculation of the β function in SU(2) lattice gauge theory is presented, using the blocking transformation proposed by Swendsen. I outline a strategy for improving the action using Monte Carlo methods and present some preliminary results.

34640 **Bianchi-Backlund transformations, conservation laws, and linearization of various field theories.** Chau, L.L. (Physics Dept. Brookhaven National Lab. Upton, NY 11973). pp 249-277 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

The parallel development of parametric Bianchi-Backlund transformations (BT), local conservation laws, non-local conservation laws, and inverse scattering equations ("linearization") in chiral fields, super-chiral fields, self-dual Yang-Mills equations in 4 dimension, and loop-space chiral equations is studied. From this exercise the elegance of introducing fermion fields via super-space symmetry, to view these theories in a unified way, can be appreciated. The status of the development of BT, conservation laws, linearization, and s-matrix are summarized for all fields.

34641 **SU(5) without SU(5): why B-L is conserved and baryon number not in unified models of quarks and leptons.** Lipkin, H.J. (Fermi National Accelerator Lab. Batavia, IL 60510). pp 281-305 of The high-energy limit. Zichichi, A. New York, NY; Plenum Publishing Corp. (1983). (CONF-800778—).

From 18. course: the high energy limit; Erice, Trapani, Italy (31 Jul 1980).

The search for a gauge theory to unify SU(2) and U(1) has led to SU(5). Quark-lepton unification of SU(5) is examined without assuming higher symmetries to preclude the discovery of accidental symmetry (which happened in SU(3)). Properties generally attributed to SU(5) but which are already present without the assumption of SU(5) are sought. The conservation of B-L is studied. The most general S matrix for thirty quarks and leptons in the first generation are examined. Three types of helicity occurring in four point functions--helicity conserving, double flip, and single flip processes are studied. An underlying SU(5)-like structure in the quantum numbers of existing particles, and SU(5)-like properties in the four point S matrix are found.

34642 **Death of fractional topological charge.** Pinsky, S.S. (Ohio State Univ., Columbus, OH 43210). pp 349-358 of Gauge theories, massive neutrinos, and proton decay. Kursunoglu, B.; Perlmutter, A. New York, NY; Plenum Publishing Corp. (1981). (CONF-810134—).

From Orbis scientiae conference; Fort Lauderdale, FL, USA (19 Jan 1981).

This chapter examines the varying of vacuum energy of QCD with respect to arbitrary chiral SU(N) rotations at a fixed instanton angle. Offers comments on confusions in the literature concerning chirality selection rules and fractional topological charge. Discusses notation, chiral selection rules and fractional topological charge. Attempts to identify the correct perturbative Hamiltonian and the perturbative vacuum when an absolute minimum is achieved.

6455 Scattering Theory

34643 **(CNRS-CPT—82-PE-1412) Short range expansion.** Holden, H.; Hoegh-Krohn, R.; Johannesen, S. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Nov 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751558.

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Let V be short range potential and lambdasub(i)(epsilon) analytic functions. We show that the Hamiltonians Hsub(epsilon) converge in the strong resolvent sense to the point interactions as epsilon $\rightarrow$ 0, and if Vsub(i) have compact support then the eigenvalues and resonances of Hsub(epsilon) which remains bounded as epsilon $\rightarrow$ 0, are analytic in epsilon in a complex neighbourhood of zero. We compute in closed form the eigenvalues and resonances of Hsub(epsilon) to the first order in epsilon.

34644 **(DESY—83-116) Relation between finite size effects and elastic scattering processes.** Luescher, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751482.

Finite volume effects on the mass spectrum of massive quantum field theories (including QCD) are shown to be related to forward scattering amplitudes of the infinite volume theory. Using theoretical and experimental information on the latter, the finite size effects can be estimated. For the pion and the nucleon they are

found to be small, provided msub(π)L>=1 (msub(π): pion mass, L: box size).

34645 (DOE/ER/70004—363) Quadratic constraints in amplitude analysis. Moravcsik, M.J. (Oregon Univ., Eugene (USA)). 1983. Contract AT06-76ER70004. 14p. (OITS—219). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013753.

Portions are illegible in microfiche products.

The quadratic constraints among bilinear products of reaction amplitudes for a reaction with arbitrary spins are discussed in terms of the experimental observables. While the specific form of these constraints may be quite lengthy, the optimal formalism of polarization phenomena exhibits the structure of these constraints transparently and gives a systematic procedure to calculate them. Some general features of these constraints are exhibited which are useful for planning experiments. Such features can be recognized without the lengthy calculations, with the help of a diagrammatic analog combined with the transparent structure of the optimal formalism.

34646 (KFK—3063-Suppl.1) Karlsruhe code MODINA for model independent analysis of elastic scattering of spinless particles. Gils, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Dec 1983. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751450.

The Karlsruhe code MODINA (KfK 3063, published November 1980) has been extended in particular with respect to new approximations in the folding models and to the calculation of errors in the fourier-Bessel potentials. The corresponding subroutines replacing previous ones are compiled in this first supplement. The listings of the fit-routine-package FITEX missing in the first publication of MODINA are also included now.

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 33445, 33446

34647 (BONN-HE—83-22) Photonuclear physics at the Bonn synchrotrons. Present status and future plans at the Bonn synchrotron. Mecking, B.A. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Nov 1983. 37p. (CONF-8309204—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751434.

From INS symposium on high energy photonuclear reactions and related topics; Tokyo, Japan (29 Sep 1983).

The activities in the field of photonuclear physics at the Bonn 500 MeV and 2.5 GeV synchrotrons are reviewed. The experiments concentrate on photodisintegration and pion-photoproduction reactions on light nuclei.

34648 (CONF-8308177—Summ.) Gordon Conference on Nuclear Research. Austin, S.M. (Rhode Island Univ., Kingston (USA)). Sep 1983. Contract FG02-83ER40116. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013277.

From Gordon conference on nuclear structure; Tilton, NH, USA (15 Aug 1983).

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Session topics were: quarks and nuclear physics; anomalons and anti-protons; the independent particle structure of nuclei; relativistic descriptions of nuclear structure and scattering; nuclear structure at high excitation; advances in nuclear astrophysics; properties of nuclear material; the earliest moments of the universe; and pions and spin excitations in nuclei.

34649 (DOE/ER/05223—68) Intermediate-energy nuclear theory. Progress report, March 1, 1982-February 29, 1984. Bryan, R.A.; VerWest, B.J.; Dominguez, C.A. (Texas A and M Univ., College Station (USA). Dept. of Physics). May 1984. Contract AS05-76ER05223. 41p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012971.

Research progress is reported on the following topics: nucleon-nucleon theory and phase-shift analysis; three-hadron systems; hadronic form factors; and theory of elementary Dirac particles. (WHK)

34650 (INIS-BR—119) Annual progress report of 1981. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. 174p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780333.

Separate entries were made in the data base for the report summaries. (WHK)

34651 (INIS-mf—8935, pp 579-591) Closing talk. Nagamiya, S. (Tokyo Univ. (Japan). Dept. of Physics). Aug 1983. NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780275. (CONF-830674—).

From 6. international Balaton topical conference on high energy nuclear physics; Balatonfured, Hungary (6 Jun 1983).

The closing talk of the International conference on high energy nuclear physics (Hungary, June 1983) summarizes the main topics discussed during the conference: new developments in the field of basic dynamics, concurrent cascade and flow models, new four-pi data, considerations and experiments on phase transitions in nuclear matter (liquid-gas or nuclear matter - quark matter), pion condensation, exotic nuclei produced in heavy ion reactions, and the subjects under hot discussion: anomalon, entropy production, possible stable exotic states etc. The papers presented on the conference are abstracted and indexed individually. (D.Gy.).

34652 (Juel-Spez—202) Annual report 1982 of the Institute of Nuclear Physics at Kernforschungsanlage Juelich. Gruemmer, F.; Mayer-Boericke, C.; Schult, O.; Seyfarth, H.; Speth, J.; Turek, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Apr 1983. 162p. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik.

This annual report contains extended abstracts about the work performed at the named institute during 1982 together with a list of publications. The work concerns the study of nuclear reactions and scattering processes, nuclear spectroscopy, the theory of nuclear structure and nuclear reactions, heavy ion reactions, solar energy, the development of the isochronous cyclotron, the spectrometer BIG KARL, detectors, and targets, as well as computer developments.

6511 Experimental Techniques

34653 Behavior of nuclei at high angular momentum. Stephens, F.S. (Lawrence Berkeley Lab., CA (USA)). pp 2-22 of Proceedings of 1982 INS international symposium on dynamics of nuclear collective motion, at the foot of Mt. Fuji. High spin states and transitional nuclei. Ogawa, K.; Tanabe, K. (eds.). Tokyo, Japan; Tokyo Univ., Inst. for Nuclear Study (1982). (CONF-820738—).

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

The present report begins with a brief overview of nuclear shapes and level structures at high-spin values. The new spectroscopy associated with angular-momentum alignments is described, and some of the exciting possibilities of this spectroscopy are explored. Nuclear moments of inertia are discussed and a somewhat different one is defined, together with a method for measuring it and some early results. Finally a few comments on the future prospects for high-spin physics are offered.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 34742

34654 (INIS-SU—198, pp 323) **Study of the d + p → p + p + n reaction in collinear geometry.** Golovkov, M.S.; Zatekin, V.V.; Kondrat'ev, S.N.; Mikhaleva, T.N.; Popova, A.M.; Chuprunov, D.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34655 (INIS-SU—198, pp 350) **Study of inelastic photoproduction of neutral pions on a helium nucleus.** Anan'in, P.S.; Glavanakov, I.V.; Gushtan, M.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34656 (INIS-SU—198, pp 184) **Energy spectra of light nuclei in potential with forbidden states.** Dubovichenko, S.B.; Zhusupov, M.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104.

In Summaries of reports of 23. Conference on nuclear spectroscopy and nuclear structure.

34657 **(LA-UR—84-1871) K^+-nucleus interaction.** Gibbs, W.R. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-8405193—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013901.

From Conference on the intersections between particle and nuclear physics; Steamboat, CO, USA (23 May 1984).

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The K^+-nucleus system is reviewed and comparison with data is made. The principal conclusions are that the theoretical uncertainties in relating the K^+-nucleus interaction to the K^+-nucleon interaction are very small and hence the positive kaon makes an excellent probe of the nucleus. It is suggested that this particle may be more sensitive to non-nucleonic degrees of freedom (especially quarks) than classical probes.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 34673

34658 **(BNL—34846) Gamma-ray spectroscopy of hypernuclei.** Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 28p. (CONF-840530—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013142.

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

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The study of hypernuclei is a frontier area of nuclear physics. As more intense beams of strange mesons have become available, methods of in-beam spectroscopy have been applied to the study of hypernuclei. The feasibility of detecting hypernuclear electromagnetic radiation has been demonstrated at the Brookhaven Alternating Gradient Synchrotron. Studies have been made of the effective LAMBDA hyperon-nucleon interaction in p-shell hypernuclei. The first results are described and they place useful constraints on the effective interaction and the shell model description of hypernuclear states.

34659 (INIS-BR—107, pp 49-52) **Quasi-free scattering and nuclear structure investigation.** Maris, T.A.J.; Schneider, C.; Vasconcellos, C.A.Z. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34660 **(INIS-mf—8392) Analyzing power Asub(y)(THETA) for ^{12}C(n vector,nsub(0,1))^{12}C in the neutron energy range from 6.8 to 17.3 MeV.** Woye, E. (Tuebingen Univ. (Germany, F.R.). Fakultaet fuer Physik). 7 Jun 1982. 118p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780238.

The analyzing power for the elastic and inelastic neutron scattering to the first excited state on ^{12}C was measured at 21 energies from 6.8 to 17.3 MeV. The data from 8.9 to 14.9 MeV were together with very precise cross section data from the literature studied in the framework of the spherical optical model and the coupled channel formalism. The coupled channel analysis of the elastic and inelastic scattering on ^{12}C in the framework of the rotator model yielded a good agreement between measured and calculated angular distributions. The determined quadrupole deformation parameter β_2 = -0.67 agrees well with values from the literature. The existence of different qudrupole deformations for the central and spin-orbit components of the optical potential was studied. Large differences for the quadrupole deformations $\beta_2$sup(c) and $\beta_2$sup(so) were found at 8.9, 11.9, and 12.9 MeV. Especially at 8.9 MeV by this a great improvement of the fit to the data was reached. (orig./HSI).

34661 (INIS-SU—198, pp 328) **^{11}B(^{4}He,^{7}Li)^{8}Be reaction at Esub(sup(4)He)27.2 MeV.** Dobrikov, V.N.; Nemets, O.F.; Gass, A.S.; Shvedov, A.A.; Stepanenko, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34662 (INIS-SU—198, pp 348) **Two-cluster disintegration of lithium isotopes in interactions with γ-quanta and μ^--mesons.** Burkova, N.A.; Zhusupov, M.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34663 (INIS-SU—198, pp 355) **Detection of a direct process in the ^{12}C(^{14}N,d)^{24}Mg reaction.** Artemov, K.P.; Golovkov, M.S.; Gol'dberg, V.Z.; Petrov, I.P.; Rudakov, V.P.; Serikov, I.N.; Timofeev, V.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34664 (INIS-SU—198, pp 361) **Secondary low-energy particles emitted in spallation of photoemulsion nuclei by 0.1-1 GeV/N ^{56}Fe nuclei and the fireball model.** Antonchik, V.A.; Bakaev, V.A.; Bogdanov, S.D.; Vikhrov, A.V.; Dudkin, V.E.; Iroshnikov, V.V.; Nefedov, N.A.; Ostroumov, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34665 **(LA—10064-T) Elastic and inelastic scattering of polarized protons from carbon-12 at 400, 600, and 700 MeV.** Jones, K.W. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 331p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84013875.

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Good resolution cross section and analyzing power (p vector, p') data for many states in ^{12}C up to an excitation energy of 21 MeV and spanning a momentum transfer range of 0.3 to 2.1 fm^{-1} were obtained using the High Resolution Spectrometer at the Clinton P. Anderson Meson Physics Facility at incident beam ener-

gies of 398, 597, and 698 MeV. Optical model potentials were obtained from the elastic scattering data. Inelastic data were analyzed in the Distorted Wave Impulse Approximation using the Love-Franey effective nucleon-nucleon interaction. The energy dependent isoscalar natural parity cross sections were underestimated, while phase difficulties were encountered in fitting analyzing powers. The energy independent isovector natural parity cross sections were reasonably reproduced, but analyzing powers were not, the calculations yielding positive trends whereas the data are of opposite sign. The energy independent isoscalar and isovector unnatural parity cross sections were quite well reproduced up to moderate momentum transfers, and striking successes were observed for some analyzing power data. Systematics of energy dependence together with the results of the DWIA calculations permitted the assignment of spin, parity and isospin quantum numbers to states in the 18-21 MeV excitation region. 64 references.

6514 Nuclear Properties And Reactions, A=20-38

34666 **(DOE/ER/40048—88-L3) Giant dipole resonances built on highly excited states of light nuclei.** Snover, K.A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1983. Contract AC06-81ER40048. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013824.

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New features of nonstatistical and statistical giant dipole resonances built on excited states of light nuclei are discussed.

34667 **(FRNC-TH—1531) Contribution to the study of heavy-ion induced quasi-elastic processes in the 2s-1d shell.** Greiner, A. (Paris-7 Univ., 75 (France)). Jun 1982. 97p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751580.

In the first part of this thesis, we present a study of the charge exchange reaction $^{28}Si(^{18}O,^{18}F)^{28}Al$ at 56 MeV. This reaction can be easily understood in terms of a one-step direct charge exchange mechanism. With a very simple shell model, it can be interpreted that a neutron of the ^{18}O in the Jsup(π)=0^+, T=1 state interacts with a proton in the dsub(5/2) shell of ^{28}Si and they exchange their spin and charge forming Jsup(π)=1^+, T=0 ^{18}F, and Jsup(π)=3^+ or 2^+, T=1 ^{28}Al. In the present analysis of data, we have first performed the direct charge exchange DWBA calculations. These results are compared with the exact-finite-range (EFR) second order DWBA calculations which take into account the successive one-nucleon stripping and pickup, and pickup and stripping process. In the second part, we wish to report results and analysis concerning the $^{24}Mg+^{12}C$ system. The 180° c.m. angle scattering excitation functions were measured between 12- and 27-MeV c.m. corresponding to a range in the compound ^{36}Ar excitation energy of 28.3 to 43.3 MeV. Several angular distributions for the elastic and inelastic scattering have been measured on the top of the bumps of the elastic scattering excitation function. These elastic scattering angular distributions cannot be fitted by a single squared Legendre polynomial of order L. A complete phase shift analysis is presented. We discuss also the shapes of the first ^{24}Mg 2^+ inelastic scattering angular distributions with respect to the shape of the elastic scattering differential cross section.

34668 (INIS-SU—198, pp 252) **Experimental study on the continuous energy distribution of internal bremsstrahlung quanta allowing ^{35}S beta decay by threshold detector method.** Shumejko, A.P.; Rubanov, A.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34669 (INIS-SU—198, pp 290) **Analysis of scattering of protons with energy near 6 MeV on nuclei with A=26,50.** Korbetskij, E.V.; Kolozhvari, A.A.; Zarubin, P.P.; Gusev, V.P.; Antropov, A.E. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34670 (INIS-SU—198, pp 245) **Analysis of level densities of the ^{28}Al and ^{32}P nuclei.** Solin, L.M.; Kuzmin, V.N.; Nemilov, Yu.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 34669, 34699

34671 **(CEA-CONF—7095) Nuclear structure and intermediate energy hadron probes: excitation of high energy multipole resonances by inelastic scattering of 340 MeV and 480 MeV α-particle.** Faraggi, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1983. 15p. (CONF-8310269—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751573.

From French-Japanese colloquium on comparison between hadronic and nuclear research at intermediate energies; Dogashima, Japan (3 Oct 1983).

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We have used alpha particle beams of 340 MeV and 480 MeV bombarding isotopically enriched ^{208}Pb, ^{116}Sn and ^{58}Ni targets to explore with good confidence the nuclear structure of the continuum. In that study, we have used a consistent way for extracting the back-ground. We have made a multipole decomposition of the spectra, without any assumption on shape and position of the resonances. We have found a good agreement with previous studies for the low part of the spectra, and make a full exploration of the previously suspected hexadecapole peak. In the 3hω we have shown the presence of L=5 strength, and put at it exact value the L=1 compression mode, for the three studied nuclei. Moreover, we have indications of L=4 and L=2 resonances in the 4hω mode, and possibly of L=5 and 3 numbers of the 5hω modes: they should be compression modes. Then, it seems, that, with intermediate energies with good statistics and coherent ways of treating the data, we have been able to see the highest excitations predicted by the models.

34672 **(FRNC-TH—1404) Study of elastic and inelastic scattering of ^{12}C on ^{40}Ca and ^{48}Ca.** Le Metayer, C. (Paris-11 Univ., 91 - Orsay (France)). Jun 1982. 87p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751581.

Angular distributions in elastic and inelastic scattering of ^{12}C on ^{40}Ca and ^{48}Ca at 34.6 MeV (c.m.) were measured. The experimental results are presented and discussed using the optical model and the semi-classical analysis.

34673 (INIS-BR—107, pp 47-48) **Spin and isospin dependence on (p,pN) quasi-free reactions.** Maris, T.A.J.; Teodoro, M.R.; Veit, E.A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34674 (INIS-SU—198, pp 287) **Analysis of experimental data on inelastic scattering of protons with approximately 6 MeV energy in ^{58}Ni.** Andronov, Yu.F.; Chubinskij, O.V.; Vinogradov, L.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34675 (INIS-SU—198, pp 297) **Multiplicity of nuclear spallation products.** Bakanov, L.V.; Ermakov, K.N.; Lebedev, V.D.; Miroshkin, V.V.; Pashuk, V.V.; Stabnikov, M.V.; Tverskoj, M.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34676 (INIS-SU—198, pp 298) **Cross section for 1 GeV proton interaction with ^{40}Ar nuclei.** Bakanov, L.V.; Ermakov, K.N.; Lebedev, V.D.; Miroshkin, V.V.; Pashuk, V.V.; Stabnikov, M.V.; Tverskoj, M.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34677 (INIS-SU—198, pp 309) **Description of the total cross sections for neutron scatteripg on germanium isotopes in the energy range approximately 1 MeV using the generalized optical model.** Musaelyan, R.M.; Skorkin, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34678 **(KFK—3642) Investigation of the reaction ^{6}Li + ^{40}Ca at 156 MeV in a coincidence experiment.** Freindl, L.; Grotowski, K.; Planeta, R.; Klewe-Nebenius, H.; Neumann, B.; Buschmann, J.; Gils, H.J.; Rebel, H.; Zagromski, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie). Dec 1983. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751449.

The cross sections for inelastic break up have been studied for the ^{6}Li + ^{40}Ca reaction at Esub(Li) = 156 MeV. For this, gamma ray spectra from the heavy residual nuclei were measured in coincidence with beam velocity projectile fragments. The cross sections were found to be: 34 +- $_{9}^{14}$ mb for protons, 30 +- $_{7}^{12}$ mb for deuterons, and 78 +- $_{41}^{142}$ mb for α-particles, respectively. These values are small when compared to total break up cross sections. A comparison of the cross section sum of all known reaction paths induced by ^{6}Li + ^{40}Ca at 156 MeV with total reaction cross section indicates a missing cross section of the order of a few hundred millibarns. It is discussed whether this cross section may be attributed to pick up reactions.

34679 **Cross section measurement for the ^{52}Cr(n,p)^{52}V reaction near threshold.** Smith, D.L.; Meadows, J.W. (Argonne National Laboratory, Applied Physics Division 9700 South Cass Avenue, Argonne, Illinois 60439). *Nuclear Science and Engineering;* **76**: No. 1, 43-48(Oct 1980).

Cross sections for the ^{52}Cr(n,p)^{52}V reaction have been determined in the 5.3- to 9-MeV range using a previously reported pulsed-accelerator technique to measure gamma-ray activity from 3.75-m ^{52}V. Very few experimental data have been reported for this reaction, and little was known about the threshold region prior to the present experiment. The results of this work (in conjunction with other available cross section information) have been used in the computation of fission-spectrum averages, which are of interest for reactor applications.

6516 Nuclear Properties And Reactions, A=59-89

34680 **(CONF-8404170—2) Half-life of ^{60}Fe.** Kutschera, W.; Billquist, P.J.; Frekers, D.; Henning, W.; Zeng, M.X.; Pardo, R.; Paul, M.; Rehm, K.E.; Smither, R.K.; Yntema, J.L. (Argonne National Lab., IL (USA); Brookhaven National Lab., Upton, NY (USA)). 1984. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013446.

From 3. international symposium on acceleration mass; Zurich, Switzerland (10 Apr 1984).

The half-life of ^{60}Fe has been measured to be T/sub 1/2/ = (1.5 +- 0.3) x 10^{6} y, significantly longer than the only previous measurement of Roy and Kohmann which reported a value of 3 x 10^{5} y uncertain by a factor of 3. The present value was obtained from a specific activity and radioisotope concentration measurement of a material produced by spallation of copper with 191-MeV protons. ^{60}Fe/Fe ratios in the range of 10^{-8} were measured with the Argonne FN tandem-superconducting linear accelerator system in conjunction with an Enge split-pole spectrograph. The specific activity was measured through the grow-in of the 1.332 MeV gamma-ray line of the ^{60}Co daughter activity. 13 references.

34681 (INIS-BR—119, pp 34-35) **Phenomenologic model for related cross sections in the reactions sup(A) Zn (α, Xn, Yp, Zα).** Mariscotti, M.A.J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Barros, S. de (Rio de Janeiro Univ. (Brazil). Inst. de Fisica); Auler, L.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

34682 **(INIS-mf—8393) Beta spectroscopy on neutron-rich nuclei of mass 93<=A<=100.** Pahlmann, B. (Technische Univ. Braunschweig (Germany, F.R.). Naturwissenschaftliche Fakultaet). 9 Dec 1982. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780239.

In the present thesis for the first time measurements of the Qsub(β) value of the neutron-rich fission products sup(99,100)Sr and ^{99}Rb were performed. Preliminary results could be obtained on the beta decays of the nuclides ^{100}Rb and ^{100}Y. (orig./HSI).

34683 (INIS-SU—198, pp 305) **Angular anisotropy of neutron inelastic scattering on Se nuclei and the role of the direct reaction mechanism in the range of E approximately 1 MeV.** Konobeevskij, E.S.; Kudenko, Y.G.; Mordovsko, M.V.; Popov, V.I.; Skorkin, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34684 (INIS-SU—198, pp 358) **^{6}Li fragmentation on ^{59}Co target at 41 MeV.** Bochkarev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Chulkov, L.V.; Yan'kov, G.B. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34685 **Activation cross sections for ^{66}Zn(n,p)^{66}Cu.** Smith, D.L.; Meadows, J.W. (Argonne National Laboratory, Applied Physics Division Argonne, Illinois 60439). *Nuclear Science and Engineering;* **76**: No. 1, 61-66(Oct 1980).

Cross sections for the ^{66}Zn(n,p)^{66}Cu reaction have been measured in the 4.2- to 10-MeV energy range using conventional activation techniques. This work provides results for an energy region where no other data are available. These results, and values from the literature for energies above 13 MeV, are used to provide an estimation of the cross section excitation function from about 4.2 to 20 MeV. An extrapolation of the cross section from 4.2 MeV to the effective threshold at about 3 MeV is derived from calculations based on a semiempirical model that is fitted to the experimental data at higher energies. This excitation function is used to compute fission-spectrum-average cross sections, which are compared with corresponding values from the literature.

34686 **Measurement of cross sections for the $^{63}Cu(n,\alpha)^{60}Co$ reaction from threshold to 10 MeV.** Winkler, G.; Meadows, J.W.; Smith, D.L. (Argonne National Laboratory, Applied Physics Division 9700 South Cass Ave., Argonne, Illinois 60439). *Nuclear Science and Engineering;* **76**: No. 1, 30-42(Oct 1980).

Cross sections for the $^{63}Cu(n,\alpha)^{60}Co$ reaction have been measured by activation for neutron energies from threshold to 10 MeV relative to well-known ^{238}U fission cross sections. The data obtained are compared with values from the literature and the resulting spectrum-averaged cross sections based on the new results are given for the ^{235}U thermal fission and ^{252}Cf spontaneous fission neutron field. The new results indicate tbat the long-standing discrepancy between differential and integral data for the reaction $^{63}Cu(n,\alpha)^{60}Co$ has been eliminated.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 34726, 34727

34687 **(CEA-CONF—7127) Nuclear studies with high energy electrons.** Frois, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1983. 16p. (CONF-8310269—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751585.

From French-Japanese colloquium on comparison between hadronic and nuclear research at intermediate energies; Dogashima, Japan (3 Oct 1983).

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The role of high energy electrons as a probe of nuclear structure is expanding considerably. It is now possible to determine much more accurately the structure of the nucleus and to disentangle some of the interactions between its constituents. The nuclear charge and magnetization densities can be determined in great detail by electron scattering, giving the spatial distribution of the nucleons very precisely even in the innermost region of the nucleus. The remarkable advantage of high energy electron scattering for studying the short range processes in nucleon-nucleon interactions is the possibility of mapping out, quantitatively and with great accuracy, the currents associated with meson exchanges between nucleons. This is accomplished by selecting carefully the kinematical conditions of the experiments. For example, the various currents which contribute to the electron scattering cross section can often interfere strongly with each other resulting in minima in the cross section at specific momentum transfers. Therefore the different meson-exchange-currents can be isolated by varying the momentum transferred to the nucleus, q, by the electrons, provided that a sufficient range of q is available. Existing accelerators at MIT and Saclay provide energies of the order of 700 MeV which are sufficient to probe details of the order of Δr approximately equal to 0.8 fm; at SLAC with 20 GeV electrons, a scale of distance of 0.1 fm can be explored. In between it is a great desert which is now one of the challenge of the future. In this talk, I have chosen only a few striking examples of the progress achieved recently.

34688 **(FRNC-TH—1532) Study of neutron-deficient Sn isotopes.** Auger, G. (Paris-7 Univ., 75 (France)). May 1982. 165p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751578.

The formation of neutron deficient nuclei by heavy ion reactions is investigated. The experimental technique is presented, and the results obtained concerning Sn and In isotopes reported: first excited states of ^{106}Sn, high spin states in ^{107}Sn and ^{107}In; Yrast levels of ^{106}Sn, ^{107}Sn, ^{108}Sn; study of neutron deficient Sn and In isotopes formed by the desintegration of the compound nucleus ^{112}Xe. All these results are discussed.

34689 (INIS-BR—119, pp 31-33) **Isomeric ratio in the ^{90}Zr (^{3}He, 2n)^{91}Mo reaction.** Cabral, S.C.; Lemos Junior, O.F.; Silva, A.G. da; Auler, L.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The isomeric ratio in the $^{90}Zr(^{3}He, 2n)^{91}Mo$ reaction, is studied. The method used is the recoil nucleus transportation by helium jet.

34690 (INIS-BR—119, pp 41) **Desintegration schemes of ^{92}Tc.** Antunes, L.J.; Auler, L.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

34691 (INIS-BR—119, pp 46-53) **Excitation function and isomeric ratio of the reaction $^{103}Rh(^{3}He, xn)$ sup(106-x) Ag, where x = 2, 3 and 4.** Borges, A.M.; Silva, A.G. da; Auler, L.T.; Lemos Junior, O.F. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

34692 (INIS-SU—198, pp 284) **Restoration of neutrino spectra from ^{235}U and ^{239}Pu fission products on the base of beta spectra.** Borovoj, A.A.; Klimov, Yu.V.; Kopejkin, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34693 (INIS-SU—198, pp 291) **Analysis of 6 MeV proton scattering on Pd even-even nuclei and dependence of the power of an imaginary part of the optical potential on the mass number.** Kukhtina, I.N.; Zarubin, P.P.; Vasil'eV, S.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34694 (INIS-SU—198, pp 322) **Study of the $^{115}In(d,t)^{114}An$ and $^{113}In(d,p)^{114}In$.** Anderson, Eh.; Klapdoy, G.V.; Sakharov, S.L.; Kharov, Yu.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34695 (INIS-SU—198, pp 336) **Study on the energy dependence of γ-quantum yield in the interaction of ^{3}He and ^{4}He ions with sup(96,98)Ru.** Zarifov, R.A.; Antsyferov, O.V.; Dombrovskaya, G.S.; Kovrigin, O.D. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34696 (INIS-SU—198, pp 542) **Activation of isomeric states of nuclei in reactions of inelastic scattering of photons and neutrons in activation analysis at electron accelerator.** Ganzha, A.P.; Davydov, M.G.; Chaves, M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34697 (INIS-SU—198, pp 190) **M2-transitions in odd tin isotopes.** Andrejchev, V.; Vdobin, A.I.; Stoyanov, Ch. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104.

In Summaries of reports of 23. Conference on nuclear spectroscopy and nuclear structure.

34698 (INIS-SU—198, pp 209) **Investigation of a magnetic dipole resonance with account for antinuum and spin-multipole forces.** Kuliev, A.A.; Salamov, D.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104.

In Summaries of reports of 23. Conference on nuclear spectroscopy and nuclear structure.

34699 **(UCID—20101) Double differential cross sections for (p,n) reactions of 18 and 25 MeV protons with isotopes of Cr, Fe, Co, Ni, Cu, Y, Zr, Mo, Pd and Tb.** Scobel, W.; Blann, M.; Komoto, T.; Trabandt, M.; Grimes, S.M.; Hansen, L.F.; Pohl, B.A.; Wong, C. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 158p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013190.

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Cross sections for the inclusive production of neutrons from reactions of 25 MeV protons with $^{50\ 52\ 53}$Cr, $^{54\ 56\ 58}$Fe, ^{59}Co, ^{60}Ni, ^{63}Cu, ^{89}Y, $^{90\ 91\ 92\ 94}$Zr, $^{92\ 94\ 95\ 96\ 97\ 98\ 100}$Mo, ^{110}Pd and ^{159}Tb and of 18 MeV protons with $^{90\ 91\ 92\ 94}$Zr have been measured with time-of-flight techniques for 16 angles between $3.5^{0} \leqq \theta$/sub lab/ $\leqq 159.0^{0}$. After a short presentation of the motivations for these measurements, the experimental set up is discussed with emphasis on the systematic and statistical error sources pertinent to this work, in particular the question of background correction in the continuous parts of the spectra. The main purpose of this report is to make the experimental results of this work (angle integrated spectra, angular distributions) available for distribution, reducing thereby the data required in publication of the results of these experiments. 20 references.

34700 **Cross section measurement for the reaction /sup 103/Rh (n,n') /sup 103m/Rh .** Paulsen, A.; Liskien, H.; Vaninbroukx, R.; Widera, R. (Commission of the European Communities, Joint Research Centre Central Bureau for Nuclear Measurements, B-2440 Geel). *Nuclear Science and Engineering;* **76**: No. 3, 331-335(Dec 1980).

The excitation function for the reaction /sup 103/Rh (n,n') / sup 103m/Rh was measured by the activation technique from 0.2 to 6.1 MeV in 0.1-MeV steps and from 13.0 to 16.7 MeV in 1-MeV steps. This excitation function is normalized through an absolute measurement at 1.8 MeV. This measurement is based on n-p scattering for neutron flux determination and on liquid scintillation counting of /sup 103m/Rh separated from /sup 103/Pd solutions for the activity determination. The total uncertainty of the cross-section results is typically + or -5% above 0.5 MeV (about + or -10% above 13 MeV). Concurrence with existing data is good except below 0.35 MeV, where the present results are considerably higher.

34701 **Ru(n,γ) cross sections above 2.6 KeV.** Macklin, R.L.; Halperin, J. (Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tennessee 37830). *Nuclear Science and Engineering;* **73**: No. 2, 174-185(Feb 1980).

Neutron capture by the heavier stable ruthenium isotopes and by natural rhodium has been measured at the Oak Ridge Electron Linear Accelerator time-of-flight facility up to 500 to 700 KeV. Most of these isotopes are important as fission products. Strength functions S^{0}, S^{1}, S^{2}, and S /SUP ug/ were fitted to the average cross sections derived for the pure isotopes up to 113 KeV. Resonance parameters were fitted for about100 cross-section peaks for each isotope.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 34726

34702 **(CONF-840530—3) Competing nuclear structures in $^{182-188}$Hg.** Ramayya, A.V.; Ma, W.C.; Hamilton, J.H.; Robinson, S.J.; Zhao, K.; Cole, J.D.; Zganjar, E.F.; Spejewski, E.H. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics; Louisiana State Univ., Baton Rouge (USA). Dept. of Physics; Oak Ridge Associated Universities, Inc., TN (USA)). 1984. Contract AS05-76ER05034;AS05-76ER04935;AC05-76OR00033. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012326.

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

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Recent experimental results in $^{182-188}$Hg are presented. The levels in ^{182}Hg are identified for the first time. Presently available theoretical interpretations are discussed. The results indicate that there are multiple competing nuclear structures along the yrast line. We interpret that the gradual upbend of I/sub x/ in the deformed band and the next super band are the result of aligning two h/sub 9/2/ or i/sub 13/2/ protons. 33 references.

34703 **Lifetime results for high-spin states in ^{160}Yb and ^{161}Yb.** Johnson, N.R. (Oak Ridge National Lab., TN (USA)). pp 144-157 of Proceedings of 1982 INS international symposium on dynamics of nuclear collective motion, at the foot of Mt. Fuji. High spin states and transitional nuclei. Ogawa, K.; Tanabe, K. (eds.). Tokyo, Japan; Tokyo Univ., Inst. for Nuclear Study (1982). (CONF-820738—).

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

The data on the E2 transition intensity of collective excitation accumulated through both Coulomb excitation yield and lifetime measurement have played important part in the understanding of higher angular mementum behavior. The lifetime measurement of ^{160}Yb and ^{161}Yb at ORNL is presented, and the results extracted are discussed. In order to carry out the lifetime measurement on the excited state of these nuclei, a Doppler-shift recoil-distance device ("plunger") has been designed and constructed. To produce the very high-spin state in ^{160}Yb isotopes, the 25 MV tandem accelerator was utilized. The results on the lifetime of some yrast state for ^{160}Yb and ^{161}Yb are presented as well as the problem of feeding in extracting lifetime from decay curves. The transition quadrupole moment for two members of the ground band was obtained from the measured lifetime. For both Yb isotopes, there appears to be a recognizable trend in the dropoff in transition quadrupole moment as a function of the rotational frequency, independent of the quasiparticle configuration.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 34671

34704 **(HMI-P—28/83-HF(Prepr.)) Spectroscopy of high-spin states in ^{217}Ra.** Mittag, C.; Fernandez-Niello, J.; Puchta, H.; Riess, F.; Roy, N.; Decman, D.J.; Kluge, H.; Maier, K.H.; Maj, A. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik). 1983. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751495.

The high-spin level structure of ^{217}Ra has been established up to a spin of (47/2) by means of in-beam γ-ray and conversion electron spectroscopy with (sup(12,13)C,xn) reactions on ^{208}Pb. Positive-parity levels up to $27/2^{+}$ and negative-parity states up to $(31/2^{-})$ can be qualitatively understood in terms of neutron excitations arising out of shell model configurations νg^{3}sub(9/2), νg^{2}sub(9/2) isub(11/2) and νg^{2}sub(9/2) jsub(15/2). The isomeric state at 2.4 MeV and the levels above it require both neutron and proton excitations. The E1 transitions between the negative parity and the ν^{3}sub(9/2) states suggest the presence of octupole deformed configurations. Shell model calculations provide only a qualitative description of the levels. The experimental level spac-

ings and their moderate agreement with the calculated ones suggest also the onset of deformation and of collective vibrational characteristics.

34705 (INIS-BR—119, pp 41-46) **Excitation function and isomeric ratio of reactions ^{197}Au(^{3}He, Xn) sup(200-x) Tl, where, x = 1, 2, 3 and 4.** Vinagre Filho, U.M.; Silva, A.G. da; Auler, L.T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

The excitation function of the reaction ^{197}Au(^{3}He, 3n)^{197}Tl, as well as the measurements of the excitation functions and isomeric ratios of the reaction ^{197}Au(^{3}He, 4n)^{196}Tl, are measured.

34706 (INIS-SU—198, pp 257) **sup(197)Au excitation in annihilation of positrons on bound atomic electrons.** Vishnevskij, I.N.; Zheltonozhskij, V.A.; Svyato, V.P.; Trishin, V.V.; Feoktistov, A.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34707 (INIS-SU—198, pp 341) **Nonequilibrium photoneutrons and statistical characteristics of heavy nuclei in a photonuclear experiment.** Lepestkin, A.I.; Sidorov, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 32763, 32763, 33178, 34014, 34014

34708 (DOE/ER/40048—91-L4) **Non-equilibrium excitation energy division in deeply-inelastic collisions.** Vandenbosch, R.; Lazzarini, A.; Leach, D.; Lock, D.K.; Ray, A.; Seamster, A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). Feb 1984. Contract AC06-81ER40048. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013773.

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The division of the excitation energy between the projectile-like and target-like fragment was measured for ^{56}Fe+^{238}U at 8.5 MeV/A incident energy. The excitation energy in the heavy fragment was determined from the mass asymmetry of fission fragments coincident with projectile-like fragments. For total energy losses between 30 and 70 MeV the excitation energy is found to divide more nearly equally than predicted by thermal equilibrium models and is in good agreement with expectations based on nucleon exchange models.

34709 (FRNC-TH—1590) **Study of ^{231}Th fission barrier by (d,pf) reaction. Observation of a third minimum in the fission barrier associated to the fissioning nucleus configurations.** Fabbro, B. (Paris-11 Univ., 91 - Orsay (France)). Jul 1983. 195p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84751562.

Results of fission probability and fission fragment angular distribution measurements are presented for the ^{230}Th(d,pf) reaction in the region of the sub-fission threshold resonance (E^{*}=5,85 MeV). A tandem Van de Graaff accelerator is used. The proton energy is measured by means of a QD3 magnetic spectrometer and two gas counters. The energy resolution obtained is 8 keV(deltaE/E approximately = 9.10^{-4}). The fission fragments emission angles are measured with two parallel-plates detectors, the anodes of which are made of several angular sectors. A fine structure is observed in the resonance at 5.85 MeV, the properties of which (parity splitted rotational bands) permit to conclude that a third minimum exists in the fission barrier of the ^{231}Th nucleus.

34710 (INIS-BR—119, pp 130-131) **Determination of fission product yields lanthanides and yttrium, in the ^{238}U fission with neutrons of fission spectra.** Nicoli, I.G. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)); Bellido, A.V. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1981. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number TI84780333.

In Annual Progress Report of 1981.

34711 (INIS-mf—8903, pp 71-73) **Generation of fission-fragment range data.** Dickstein, P.; Laichter, Y.; Shafrir, N.H. (Technion-Israel Inst. of Tech., Haifa. Dept. of Nuclear Engineering). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34712 (INIS-SU—198, pp 313-314) **Gamma radiation spectrum in 3 MeV neutron interaction with ^{235}U nuclei.** Blinov, M.V.; Stsiborskij, B.D.; Filatenkov, A.A.; Shiryaev, B.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34713 (INIS-SU—198, pp 230) **Rotational alignment of internal angular momentum in octupole bands.** Muminov, A.I.; Safarov, R.Kh.; Usmanov, F.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

34714 **Fission product analytic impulse source functions.** La Bauve, R.J.; England, T.R.; George, D.C.; Maynard, C.W. (University of California, Los Alamos National Laboratory P.O. Box 1663, Los Alamos, New Mexico 87545). *Nuclear Technology;* **56**: No. 2, 322-339(Feb 1982).

The intensive study of fission products and their effects carried out over the past decade has resulted in a thorough understanding of their behavior and an accurate predictive capability. A convenient form, a fitted linear combination of exponentials, has been developed for representing aggregate time-dependent decay spectra. The resulting parameters are useful in a wide variety of fission product applications. The fitted functions, which include beta and gamma aggregate spectra for total and gaseous fission products from ^{233}U and ^{239}Pu over the 0- to 10^{9}-s time interval, are readily used with any power history.

34715 **A simple formula for calculation of prompt neutron yield from spontaneous fission of transuranics.** Pai, H.L.; Andrews, D.G. (University of Toronto Department of Chemical Engineering and Applied Chemistry Toronto, Ontario M5S 1A4). *Nuclear Science and Engineering;* **76**: No. 3, 323-330(Dec 1980).

The simple statistical model statement relating the yield Y / SUB P/ of fission fragments to the effective neutron binding energy B /SUB n/ , namely Y /SUB P/ α exp(-B^{-} /SUB n/ /T), can be used as a basis for parallel developments, one leading to the well-known empirical delayed-neutron statement Y = Y_0exp(-K(3Z - A)), where Y is the number of delayed neutrons per fission. Repeating the development for prompt neutron emission leads to the analogous result $\nu^{-} = \nu^{-}_{0}\exp(-b(3Z - A))$ where ν^{-} is the prompt neutrons per fission. This semi-empirical result implies that a semi-logarithmic experimental plot of ν^{-} against (3Z - A) should be a family of straight lines. Currently available experimental results justify this prediction. The theoretical precision of this semi-empirical formula is estimated to be + or -10% or better, depending mainly on the part and shape of the fission yield-mass curve taken into account. The existence of the above empirical and semi-empirical formulas strongly suggests that the yield of fission neutrons, as well as their

spectrum, can be calculated by using the standard statistical model with non-adjustable parameters.

34716 **Note on the prompt-fission-neutron spectra of uranium-233 and -235 and plutonium-239 and -240 relative to that of californium-252.** Smith, A.; Guenther, P.; McKnight, R.; Winkler, G. (Argonne National Laboratory, Applied Physics Division 9700 South Cass Avenue, Argonne, Illinois 60439). *Nuclear Science and Engineering;* **76**: No. 3, 357-361(Dec 1980).

The prompt-neutron-induced fission spectra of ^{233}U, ^{235}U, ^{239}PU, and ^{240}PU were measured relative to the prompt-spontaneous-fission-neutron spectrum of ^{252}CF. analysis of the measured values indicates that the incremental average-fission-neutron energies relative to a ^{252}CF fission-neutron spectrum of maxwellian form with an average energy of 2.13 mev are -123 + or - 30 (^{233}U), -157 + or - 24 (^{235}U), -76 + or - 29 (^{239}PU), and -46 + or 29 (^{240}PU) kev.

34717 **The foil thickness correction in ¯ measurements and the (¯ - /eta/) discrepancy.** Bolderman, J.W.; Frehaut, J. (Centre d'Etudes de Bruyeres-le-Chatel Service de Physique Neutronique et Nucleaire, B.P. No. 561 92542 Montrouge Cedex). *Nuclear Science and Engineering;* **76**: No. 1, 49-52(Oct 1980).

The effect of the source thickness in gated Nu¯ measurements has been determined accurately. All existing Nu¯ data for thermal fission of ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu have been revised and a comparison is made with values of Nu¯ derived from the / eta/ values.

34718 **Near-equilibrium measurements of delayed neutron spectra from fast fission of plutonium-240.** Grant, P.J.; Woodruff, G.L. (University of Washington, Department of Nuclear Engineering Seattle, Washington 98195). *Nuclear Science and Engineering;* **76**: No. 1, 56-61(Oct 1980).

The near-equilibrium energy spectrum of the delayed neutrons from the fast neutron-induced fission of ^{240}Pu has been measured over the energy range from 40 to 1500 keV. The spectrum is somewhat similar in shape to near-equilibrium spectra previously reported for other isotopes, and the peak structure is consistent with results from both fissionable isotopes and from various individual delayed neutron precursors.

34719 **Experimental determination of photofission neutron multiplicities for ^{235}U, ^{236}U, ^{238}U, and ^{232}Th using monoenergetic photons.** Caldwell, J.T.; Alvarez, R.H.; Berman, B.L.; Dowdy, E.J.; Meyer, P. (University of California, Los Alamos Scientific Laboratory P.O. Box 1663, Los Alamos, New Mexico 87545). *Nuclear Science and Engineering;* **73**: No. 2, 153-163(Feb 1980).

The prompt neutron multiplicities for photofission of the four isotopes ^{235}U, ^{236}U, ^{238}U, and ^{232}Th have been measured with monoenergetic photons over the energy range from 5.5 to 18 MeV using the annihilation in flight of fast positrons. The delayed neutron yield has been measured for all four isotopes at 10.9- and 16.8-MeV photon energies. The ratio of first- to second-chance fission has been measured as a function of energy up to 17-MeV excitation energy for ^{236}U and ^{238}U photofission.

34720 **Fission product yields for thermal-neutron fission of plutonium-239.** Dickens, J.K.; McConnell, J.W. (Oak Ridge National Laboratory, P.O. Box X Oak Ridge, Tennessee 37830). *Nuclear Science and Engineering;* **73**: No. 1, 42-55(Jan 1980).

Absolute cumulative yields have been determined for 49 fission products representing 36 mass chains created during thermal-neutron fission of ^{239}Pu, including 3 mass chains for which no prior data exist. Using Ge(Li) spectroscopy, spectra were obtained of gamma rays from decay of fission products between 1550 s and 31 days after a 100-s irradiation. Data were obtained for all fission products simultaneously. Gamma rays were assigned to the responsible fission products by matching gamma-ray energies and half-lives. Gamma-ray data associated with decay of ^{135}I and ^{140}Ba-^{140}La, in particular, were thoroughly studied; uncertainties were obtained for the two largest intensity gamma rays from decay of ^{135}I that are smaller than previously evaluated uncertainties. Fission product yields were obtained from the data by first determining the appropriate gamma-ray activity as of the end of the irradiation, then correcting for detector efficiency and gamma-ray branching ratio, and, finally, dividing by the number of fissions created in the sample. The number of fissions was determined by direct comparison of gamma rays emanating from fission products created during a careful irradiation of a wellcalibrated ^{239}Pu-loaded fission chamber. The resulting fission product yields are compared with previous measurements and with recommended yields given in two recent (and independent) evaluations.

6530 Nuclear Theory

34721 **(CEA-N—2371) Piece-wise analytic evaluation of the radiative tail from elastic and inelastic electron scattering.** Maximon, L.C.; Williamson, S.E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1983. 108p. (In French and English). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751574.

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We consider here the calculation of the radiative tail from the elastic peak in medium and high energy electron scattering as well as from a discrete inelastic level of the recoiling nucleus. We examine the method generally used for this calculation, viz., a numerical integration of the differential cross section over the angles of the unobserved photon, and discuss the difficulties inherent in this numerical integration due to the sharp peaking of the integrand. We present an alternative method for calculating the radiative tail, in which the region of integration is divided into an arbitrary number of subintervals, the structure functions are fitted by cubic spline functions in each subinterval, and the integrations are performed analytically in closed form. This method has the advantages of a greatly increased accuracy and a reduction of the computation time by a factor which can vary between 10 an 10^3, depending on the kinematics.

34722 **(DOE/ER/10405—8) Theoretical studies of multistep processes and isospin effects in nuclear scattering. Progress report, May 1, 1983-April 30, 1984.** Madsen, V.A. (Oregon State Univ., Corvallis (USA). Dept. of Physics). 1984. Contract AT06-79ER10405. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013845.

Progress is reported on the following studies: calculation of microscopic optical potentials, calculation of scattering cross section from nonlocal microscopic optical potential, nuclear β/sub n/ and β/sub p/ and an extended schematic model, calculation of transition densities in open-shell nuclei, and coupled-channel equations treating antisymmetry. Publications are listed. (WHK)

34723 **(DOE/ER/40048—23-N3) Quark effects in nuclear physics.** Miller, G.A. (Washington Univ., Seattle (USA). Dept. of Physics; European Organization for Nuclear Research, Geneva (Switzerland)). 1983. Contract AC06-81ER40048. 16p. (CONF-8306136—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013843.

From International symposium on quarks and nuclear structure; Bad Honnef, F.R. Germany (13 Jun 1983).

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A phenomenological approach which enables the size of quark effects in various nuclear processes is discussed. The principle of conservation of probability provides significant constraints on six quark wave functions. Using this approach, it is found that the low-energy proton-proton weak interaction can be explained in terms of W and Z boson exchanges between quarks. That the value of the asymptotic ratio of D to S state wave functions is influenced (at the 5% level) by quark effects, is another result of our approach. We have not discovered a nuclear effect that can be uniquely explained by quark-quark interactions. However it does seem that quark physics is very relevant for nuclear physics. 52 references.

34724 **(DOE/ER/70004—376) Parton description of the nucleus fragmentation region in heavy-ion collisions.** Hwa, R.C. (Oregon Univ., Eugene (USA)). Oct 1983. Contract AT06-76ER70004. 15p. (CONF-8309168—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013751.

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

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In nucleus-nucleus collisions, the rapidity distribution of partons in the nucleus fragmentation region is highly asymmetrical. Thermalization that randomizes the momenta of partons far apart in rapidity cannot be expected. A local thermalization model is introduced which relates temperature to the range of parton interaction in rapidity. The parton number density and energy density are then calculated.

34725 **(GSI—83-38-Prepr.) Expansion and disassembly phase of energetic nuclear reactions: A problem of dynamical instabilities.** Strack, B.; Knoll, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Dec 1983. 3p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751435.

The expansion phase of a hot nuclear system as created in an energetic heavy ion collision is calculated and discussed by a self-consistent field-theoretical model which consideres dynamical growth of instabilities arising from strong fluctuations of the one-body density. First multiplicity distributions and mass spectra resulting from a series of numerical runs in a two dimensional model world are presented and discussed.

34726 **(GSI—84-1(Prepr.)) Diabatic two-center shell model.** Noerenberg, W.; Lukasiak, A.; Cassing, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1984. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751497.

Diabatic single-particle representation for the microscopic description of central nucleus-nucleus collisions within the framework of dissipative diabatic dynamics (DDD) are investigated. Based on the scaling condition for diabatic states, two construction methods referred to as the methods of maximum overlap and maximum symmetry, respectively, are studied within a two-center shell model. The conservative diabatic potential and the associated mass tensor for the pure diabatic single-particle motion, are calculated as functions of three collective variables for $^{92}Mo+^{92}Mo$ and $^{86}Kr+^{166}Er$. The calculated diabatic potentials are strongly repulsive and essentially depend only on the distance between the centers of mass in the region of strongly overlapping nuclei. The diabatic mass tensors are smooth functions of the collective variables and are close to the values for irrotational incompressible flow.

34727 **(GSI—84-2(Prepr.)) Diabatic interaction potential for nucleus-nucleus collisions.** Noerenberg, W.; Lukasiak, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751496.

Within a refined method for the construction of diabatic states allowing for the treatment of the full spin-orbit coupling, characteristic features of the diabatic potential for nucleus-nucleus collisions are investigated. Approximately 90% of the strong repulsion results from diabatic particle-hole excitations, while only 10% is due to compression. The diabatic interaction potential describes a physical situation intermediate between adiabatic and sudden approximations.

34728 (INIS-BR—107, pp 205) **Nuclear medium corrections for the Δ - isobar.** Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34729 (INIS-BR—107, pp 56-57) **Absorptive nuclear mean field of a Δ(1236) - isobar.** Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34730 (INIS-BR—107, pp 48-49) **Life time of nuclear hole states in the relativistic theory of Walecka.** Maris, T.A.J.; Schneider, C.; Steffani, M.H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34731 (INIS-BR—107, pp 63) **Nonlocality of the isobar propagation and the effective Δ-nucleus spin-orbit interaction.** Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Herscovitz, V.E.; Teodoro, M.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34732 (INIS-BR—107, pp 46) **Eikonal approximation's deviations for nucleon-nucleus scattering at medium energies.** Herscovitz, V.E.; Steffani, M.H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34733 (INIS-BR—107, pp 53) **Investigation by the nuclear relativistic theory of a deviation in the impulse approximation.** Maris, T.A.J.; Schneider, C.; Krein, G.I. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34734 (INIS-BR—107, pp 53-54) **Recent developments in quasi-free reactions.** Kitching, P.; McDonald, W.J. (Alberta Univ., Edmonton (Canada). Triumf Group); Maris, T.A.J.; Vasconcellos, C.A.Z. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number TI84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34735 (INIS-SU—198, pp 195) **Analysis of nonstatistical effects in excited state spectra of complex nuclei.** Sukhoruchkin, S.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104.

In Summaries of reports of 23. Conference on nuclear spectroscopy and nuclear structure.

34736 (INIS-SU—198, pp 199) **Selection of mixing with phonons from phenomenological characteristics of single-particle motion in magic nuclei.** Kamerdzhiev, S.P.; Tselyaev, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

34737 (INIS-SU—198, pp 243) **Analysis of empirical mass relations.** Solin, L.M.; Kuz'min, V.N.; Nemilov, Yu.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number TI84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

34738 **(LA-UR—84-1849) Lambda N-ΣN coupling in S-shell Lambda-hypernuclei.** Gibson, B.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-8405193—12). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013899.

From Conference on the intersections between particle and nuclear physics; Steamboat, CO, USA (23 May 1984).

The inclusion of Lambda N-ΣN coupling in the A = 4 Lambda-hypernuclei is shown to be required in order to obtain proper ordering of the 0^+ ground state and 1^+ spin-flip excited state, when exact four-body equations are solved. It is argued that suppression of the off-diagonal Lambda N-ΣN coupling in the A = 5 system, similar to that in the A = 4 isodoublet, should account for the anomalously small binding of ^{5}He. An alternative quark model explanation is also considered.

34739 **(LA-UR—84-1855) Double beta decay: theory.** Haxton, W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 13p. (CONF-8405193—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013900.

From Conference on the intersections between particle and nuclear physics; Steamboat, CO, USA (23 May 1984).

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A summary is given of interesting particle physics and nuclear physics issues in the theory of double beta decay. 25 references.

34740 **(LA-UR—84-1872) Antiproton-nucleus interaction.** Gibbs, W.R. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 11p. (CONF-8405193—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013902.

From Conference on the intersections between particle and nuclear physics; Steamboat, CO, USA (23 May 1984).

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Several facets of antinucleon-nucleus interactions are explored. The topics treated are: coherent interactions, production of unusual states and particles in the nuclear medium, and the creation of extreme states of matter by antimatter annihilation. It is found that temperatures of the magnitude necessary to achieve the predicted quark-gluon phase transition are obtained. 20 references.

34741 **(LA-UR—84-1873) Quark tunneling in hypernuclei.** Goldman, T. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8405193—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013903.

From Conference on the intersections between particle and nuclear physics; Steamboat, CO, USA (23 May 1984).

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A new model of nuclei is described. Its qualitative successes are discussed. Its implications for and new tests in hypernuclei are introduced.

34742 **(LA-UR—84-2027) Unitary, unified models for NN → NNπ.** Silbar, R.R. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-8405193—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014025.

From Conference on the intersections between particle and nuclear physics; Steamboat, CO, USA (23 May 1984).

First-generation unitary, unified models reproduce the new NN → NNπ data reasonably well, but there are two interesting warts in the comparison of theory and experiment. 20 references.

34743 **(LBL—17837) Macroscopic treatment of nuclear dynamics.** Swiatecki, W.J. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 27p. (CONF-8405179—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013247.

From International conference on theoretical approaches to heavy ion reaction mechanisms; Paris, France (14 May 1984).

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A qualitative classification of nucleus-nucleus reactions into four types is described, a consequence of the existence of up to three milestone configurations that a fusing system may be faced with. These considerations lead to phenomenological formulae for fusion and compound-nucleus cross-sections that may be compared with experiments by the use of rectilinear cross section plots. Examples of more specific model calculations of nuclear reactions employing the Chaotic Regime Dynamics are described. Some misunderstandings regarding the Wall and Wall-and-Window formulae, underlying this type of dynamics, are discussed in the appendix. 23 references.

34744 **Shell structure at high spin and the influence on nuclear shapes.** Khoo, T.L.; Chowdhury, P.; Ahmad, I. (Argonne National Lab., IL (USA)). pp 256-274 of Proceedings of 1982 INS international symposium on dynamics of nuclear collective motion, at the foot of Mt. Fuji. High spin states and transitional nuclei. Ogawa, K.; Tanabe, K. (eds.). Tokyo, Japan; Tokyo Univ., Inst. for Nuclear Study (1982). (CONF-820738—).

From INS symposium on dynamics of nuclear collective motion; Mount Fuji, Japan (6 Jul 1982).

Nuclear structure at high spin is influenced by a combination of liquid drop and shell structure effects. For N < 86 both contribute towards the occurrence along the yrast line of high-spin oblate aligned-particle configurations. Shell effects are mainly responsible for the prolate deformation of nuclei with N > 90. The competition between oblate and prolate driving effects leads to a prolate-to-oblate shape transition in $_{66}{}^{154}$Dy$_{88}$. The role of rotation-aligned configurations in the shape change is discussed.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 33144, 33148, 33975, 34839

34745 **(GKSS—83/E/53) Computational investigations on a catenary-shaped double-reflecting neutron guide.** Priesmeyer, H.G. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751444.

The results of Monte-Carlo calculations of the neutron transmission of a vertical catenary-shaped neutron guide are presented. A two-dimensional problem was considered. Focussing and special coatings are investigated.

34746 **(INIS-mf—8726) Intensity profiles behind a five-stage neutron interferometer.** Kischko, U. (Dortmund Univ. (Germany, F.R.). Abt. Physik). 18 Feb 1983. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84701930.

By means of the quantitative photography intensity profiles behind a five-stage ideal-crystal neutron interferometer at the thermal channel H25 of the high-flux reactor at the institute Laue-Langevin in Grenoble/France were dermined and compared with theoretical profiles. Contravily to X-rays by neutrons the hole Borrmann range is excited. This leads in the interference picture to superposition of several wave field components. It was shown that the spherical wave theory, as it was developed by W. Bauspiess, U. Bonse, and W. Graeff for the absorption-free neutron interferometer, describes well quantitatively the experimental intensity profiles. Expecially for the t-2t-t geometry the theoretically predicted focusing was confirmed. For the H-beam the intensity profile is symmetric and spatially limited; the O-beam is asymetric with intensities decreasing slowly up to the boundary. Geometrical differences within single stages lead to unique changes in the intensity profile. The pigtail pattern leading in the past to some puzzle guessing

could be explained by the influence of geometrical defocusings on the phase shift. Important conclusions for the geometrical tolerances, which have to be regarded in the construction of neutron interferometers, could be obtained. (orig.).

34747 (INIS-mf—8903, pp 50-52) **Exponentially time dependent solutions of the monoenergetic neutron transport equation for plane symmetry.** Lemanska, M.; Ilamed, Y. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number TI84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34748 **(LA—10092-T) Linear characteristic-nodal transport method for the two-dimensional (x,y)-geometry multigroup discrete ordinates equations over an arbitrary triangle mesh.** Paternoster, R.R. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013874.

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A semi-analytic numerical solution to the two-dimensional (x,y)-geometry multigroup discrete ordinates transport equations over a mesh of arbitrarily shaped triangles is derived. The numerical method uses the analytic solution of the discrete ordinates equations with a linear function for the source to generate a linear representation of the angular flux on the boundaries of the triangle. Two cases must be solved for triangular mesh cells; inflow through one face and inflow through two faces of the triangle. The one inflow side problem is solved by the linear characteristic method. The characteristic solution is used to formulate a linear moment representation of the angular flux on the two outflow faces of the triangle. The two inflow sides case is solved by the linear nodal method. The angular flux on the single outflow face is represented by a linear moment expansion. The coefficients of this expansion are obtained from the solution of the zero'th and first spatial moments of the discrete ordinates equation with a linear source representation. The linear flux coefficients are edge-centered and the cell source data are vertex centered. The moments required for the linear source are formed by finite difference expressions of the vertex source data.

34749 **(ORNL/TM—9123) Systems guide to MCNP (Monte Carlo Neutron and Photon Transport Code).** Kirk, B.L.; West, J.T. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013573.

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The subject of this report is the implementation of the Los Alamos National Laboratory Monte Carlo Neutron and Photon Transport Code - Version 3 (MCNP) on the different types of computer systems, especially the IBM MVS system. The report supplements the documentation of the RSIC computer code package CCC-200/MCNP. Details of the procedure to follow in executing MCNP on the IBM computers, either in batch mode or interactive mode, are provided.

34750 **Enhanced electron deposition.** Widner, M.M. (Sandia Laboratories, Albuquerque, NM 87185). pp 901-902 of Energy storage, compression, and switching. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—).

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter reports on how recent relativistic electron beam deposition experiments at the Sandia Laboratories have measured high material temperature and inferred correspondingly high deposition rates using 2 different diode configurations: pinched beam incident on a planar foil and C-diode (a stalk mounted foil). The pinched beam experiment was performed on the Proto-I accelerator (1.1 MV, 300 kA, 25 nsec), and the C-diode experiment was performed on the MITE accelerator (2 MV, 400 kA, 40 nsec).

34751 **Measurements of neutron and gamma-ray streaming in a cavity-duct system and an analysis by an albedo Monte Carlo method.** Shin, K.; Hyodo, T.; Murakami, R.; Oka, Y.; Taniuchi, H. (Kyoto University, Department of Nuclear Engineering Yoshida-Honmachi, Sakyo-ku, Kyoto 606). *Nuclear Science and Engineering:* **81**: No. 2, 161-171(Jun 1982).

Spectral and spatial distributions of neutrons and gamma rays were measured in a simple cavity-duct configuration to observe profiles of cavity streaming. The change of the profiles of neutrons and gamma rays is examined by blocking source neutrons with a 32-cm-thick aluminum plug. The following observations resulted from the experiments: Fast neutrons of several million electron volts energy streamed through ducts. The neutron and gamma-ray spectra were similar except in the source neutron beam. The gamma rays were predominantly those arising from neutron capture in iron. The aluminum plug greatly decreased the fast neutron flux but had only a limited effect on the low energy neutron flux. The applicability of the albedo Monte Carlo calculational method to this problem was examined with the following conclusions: For ducts of small radius, the calculations overestimate the streaming because the albedo data were given for plane geometry. Low energy neutrons were underestimated by the calculation due to the neutron penetration through the cavity wall.

34752 **Conserving average rate of energy loss in transport calculations for light charged particles.** Cullen, D.E.; Perkins, S.T. (Lawrence Livermore National Laboratory, University of California P.O. Box 808, Livermore, California 94550). *Nuclear Science and Engineering:* **81**: No. 1, 75-91(May 1982).

Methods for treating nuclear plus interference elastic scattering of light charged particles in continuous energy or multigroup transport calculations are given. These methods conserve the rate of projectile energy loss and maintain energy balance by ensuring that, on the average, the rate of projectile energy loss equals the rate of target energy gain. It is shown that this approach is equivalent to conserving the P_0 and P_1 moments of the angular distribution of scattered projectiles and targets in the center-of-mass system. The authors include an approximate method that corrects for the temperature of the medium. To illustrate the application of these methods to a multigroup problem, the authors give multigroup data for all 25 projectile/target combinations of protons, deuterons, tritons, ^{3}He ions, and alpha particles based on an example 10-group energy structure. The results are in a compact form from which the group-to-group transfer matrices can be easily calculated.

34753 **A recursive Monte Carlo method for estimating importance function distributions in deep-penetration problems.** Goldstein, M.; Greenspan, E. (Israel Atomic Energy Commission, Nuclear Research Center-Negev P.O. Box 9001, Beer Sheva). *Nuclear Science and Engineering:* **76**: No. 3, 308-322(Dec 1980).

A recursive Monte Carlo (RMC) method for estimating the importance function distribution in three-dimensional systems, intended for importance sampling applications, is developed. The method consists of dividing the system into relatively thin geometrical regions and solving the inhomogeneous forward transport equation for each of the regions. The RMC method is found to possess a number of unique features, including the ability to infer the importance function distributions pertaining to many different detectors from essentially a single Monte Carlo run. Various technical questions concerned with the practical application of the RMC method, including the questions of the accumulation of statistical and systematic errors and their dependence on the details of the system division and source batch size, are investigated. A promising algorithm for the application of the method is formulated. The practicality and efficiency of the RMC method is investigated for a number of monoenergetic problems.

34754 **A point detector scoring method compatible with Monte Carlo transport calculations of specularly reflected particles.** Iida, H.; Seki, Y. (Japan Atomic Energy Research Institute Division of Thermonuclear Fusion Research Tokai-mura, Naka-gun, Ibaraki-ken). *Nuclear Science and Engineering;* **76**: No. 3, 302-307(Dec 1980).

In using a Monte Carlo transport code, particle fluxes are underestimated with a calculational model using specular reflection boundaries when a point detector estimator that scores only the direct contribution to the detector from a collision point within the model is used. This underestimation occurs because the contributions from collision points outside the calculational model are neglected. An additional scoring scheme is developed to compensate for the discrepancy; the new scheme is implemented to threedimensional Monte Carlo transport code MORSE-GG. Validity of the method is shown by test calculations with ANISN and revised MORSE-GG.

34755 **Gamma-ray buildup factors for concrete slab shields under slant incidence conditions.** Fournie, E.M.; Chilton, A.B. (University of Illinois, Nuclear Engineering Program Urbana, Illinois 61801). *Nuclear Science and Engineering;* **76**: No. 1, 66-69(Oct 1980).

Monte Carlo calculations have been made for the penetration of slab shields by gamma radiation of monoenergetic character. The radiation is in the form of parallel, broad beams incident on the front face of the slab at various angles having cosines between 0.25 and 1.0. The beam photon energies vary between 0.661 and 6.13 MeV. The slab thicknesses extend to 10 mean-free-paths. The results are provided in the form of tables and graphs for exposure transmission buildup factors as a function of slab thicknesses. Comparison with previous work shows good agreement; however, this work goes somewhat beyond previous contributions.

34756 **A Multiregion calculation in the theory of neutron diffusion.** Garcia, R.D.; Siewert, C.E. (North Carolina State University, Nuclear Engineering Department Raleigh, North Carolina 27650). *Nuclear Science and Engineering;* **76**: No. 1, 53-56(Oct 1980).

The method of elementary solutions and the F /SUB N/ method are used to compute and report especially accurate numerical results relevant to a previously established four-region test problem in the theory of neutron diffusion.

6550 Medical Physics

REFER ALSO TO CITATION(S) 32764, 34174, 34397

34757 **(AD-A—138590/5) Provision of guidance, information and basic criteria for radiation protection and measurements. Final technical report 1 Jul-31 Dec 83.** Walker, J.T. (National Council on Radiation Protection and Measurements, Bethesda, MD (USA)). 27 Feb 1984. 24p. NTIS, PC A02/MF A01.

This report will highlight the activities of the National Council on Radiation Protection and Measurements (NCRP) and in particular, the efforts of those NCRP scientific committees or subgroups which were supported during the period between July 1983 and 31 December 1983. The report will briefly outline the overall objectives of the work, as they were defined in the original contract, including a statement about the objectives of each study, and when it is appropriate, a proposed outline of the major sections of the draft scientific reports being produced and a statement describing the current status of each project.

34758 **(AD-A—139033/5) Kerma factors for use in 37-group neutron spectrum calculations. Technical report.** Zeman, G.H.; Bice, W.S. Jr. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Dec 1983. 19p. NTIS, PC A02/MF A01.

Neutron kerma factors have been regrouped from the format of the International Commission on Radiation Units and Measurements Report 26 (ICRU-26) to supplement those available in the 37-group format of the Oak Ridge Data Library Collection 31 (DLC-31). Lists of regrouped neutron kerma factors are presented for eight elements and for seven compounds and mixtures. For several elements, disagreements in excess of 15% were observed between those neutron kerma factors available in DLC-31 and the regrouped neutron kerma factors of ICRU-26.

34759 **(INIS-mf—8904) Ordinance of 14 March 1983 concerning the Federal Commission for the Safety of Nuclear Installations.** (French Government, Paris). 14 Mar 1983. 5p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780324.

The Frederal Council issued a new Ordinance concerning the Federal Commission for the Safety of Nuclear Installations. This Ordinance replaces an Ordinance of 13 June 1960 and takes into account the distribution of tasks decided several years ago between the Commission, which operates on a part-time basis, and the principal Division for the Safety of Nuclear Installations attached to the Federal Office of Energy. (NEA).

34760 **(INIS-mf—8917) Act No. 25 of 31 January 1983 amending Act No. 1103 of 4 August 1965 and Decree No. 680 of 6 March 1968 on regulations governing the activities of technicians in medical radiology.** (Italian Government, Rome). 9 Feb 1983. 3p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780321.

Published in the Italian Official Gazette No. 38.

This Act amends Act No. 1103 of 4 August 1965 and Decree No. 680 of 6 March 1968 of the President of the Republic regulating the activities of auxiliary personnel engaged in medical radiology. It establishes new conditions for training and qualifications of such technicians in respect of radiodiagnosis, radiotherapy and nuclear medicine. (NEA).

34761 (INIS-mf—8927, pp 47-60) **Radiation sources and technical services.** Stonek, K.; Satorie, Z.; Vyskocil, I. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780240.

In 60 years of the Institute for Research, Production and Application of Radioisotopes 1919-1979.

Work is briefly described of the department for sealed sources production of the Institute, including leak testing and surface contamination of sealed sources. The department also provides technical services including the inspections of sealed sources used in medicine and geology and repair of damaged sources. It carries out research of the mechanical and thermal strength of sealed sources and of the possibility of reprocessing used ^{226}Ra sources. The despatch department is responsible for supplying the entire country with home and imported radionuclides. The department of technical services is responsible for testing imported radionuclides, assembling materials testing, industrial and medical irradiation devices, and for the collection and storage of low-level wastes on a national scale. (M.D.).

6560 Solid State Physics

REFER ALSO TO CITATION(S) 33445, 33614, 33615, 33617, 33627, 33759, 34643

34762 **(CONF-840145—3) Monte Carlo calculation of correlation and vacancy wind effects in diffusion.** Murch, G.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013458.

From INDO-US workshop on diffusion in solids; Bombay, India (9 Jan 1984).

The calculation by Monte Carlo methods of the tracer correlation factor and vacancy wind effects in diffusion is described. The Einstein equation for the correlation factor and its generalization by Allnatt to the phenomenological coefficients are reviewed. In the latter case, such equations are compared directly with the external field equations for the Monte Carlo calculation of the Haven Ratio and vacancy-wind factors. 23 references.

34763 **(DOE/ER/10444—10) Infrared absorption spectrum of free carriers in polar semiconductors. Final report, July 1, 1983-June 30, 1984.** Jensen, B.; Torabi, A. (Boston Univ., MA (USA)). Jun 1984. Contract AC02-79ER10444. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013276.

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A quantum mechanical expression for the real part of the refractive index of a III-V, II-VI, or IV-VI binary, ternary, or quaternary semiconductor has been derived which predicts the dispersion observed near the fundamental absorption edge. The calculation is made in terms of measurable experimental quantities only, with no adjustable parameters, using the Kane theory of the band structure. Results have been calculated for a wide variety of materials, and comparison made with available experimental data. An expression for the nonlinear intensity dependent refractive index is given. An extension of the Drude theory has been made which predicts the quantum result for the complex dielectric constant at high frequencies and reduces to the usual quasiclassical result in the far infrared. The results of this research are expected to find application in implementation of optical processing systems in the infrared and in the design of integrated circuits, systems, and devices based on the III-V, II-VI or IV-VI compounds. 20 references.

34764 **(DOE/ER/10913—3) Multicomponent diffusion under general chemical potential gradients. Final report, July 1, 1981-June 30, 1984.** Sato, H.; Kikuchi, R. (Purdue Univ., Lafayette, IN (USA). School of Materials Engineering). Jun 1984. Contract AC02-81ER10913. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010830.

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Theoretical basis for identifying the origin of deterioration of high temperature materials by diffusion has been sought. The need for an appropriate form of irreversible statistical mechanics, rather than commonly utilized irreversible thermodynamics, to this problem was identified. The Path Probability method of irreversible statistical mechanics was thus adapted to diffusion problems and necessary modifications of the method suitable for transport problems in multicomponent systems were made. Thermal diffusion (diffusion which occurs under temperature gradient) was then formulated by the Path Probability method for the first time, and so far elusive concepts such as the heat of transport were thus microscopically identified. An example of demixing of originally homogeneous solid solutions under general chemical potential gradients was thus worked out.

34765 (INIS-BR—107, pp 69) **Dynamics of the Heisenberg model in the reaction field approximation.** Garcia, V.H.; Gusmao, M.A.C.; Scherer, C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34766 (INIS-BR—107, pp 70) **Reaction field approximation for Heisenberg paramagnetic thin film.** Scherer, C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Wachniewski, A. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachrichtung Theoretische Physik). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34767 (INIS-BR—107, pp 74-75) **Diagramatic technique for the statistical thermodynamics of spin Hamiltonians.** Gusmao, M.A.C.; Scherer, C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34768 (INIS-BR—107, pp 77) **Green function method for a mixed valence Hamiltonian.** Rosa Simoes, A.S. da; Iglesias-Sicardi, J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Anda, E.V. (Universidade Federal Fluminense, Niteroi (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34769 (INIS-BR—107, pp 79-80) **Second quantized theory of Anderson localization in d=2+ epsilon.** Theumann, A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34770 (INIS-BR—107, pp 80-81) **First-order phase transitions in the Potts model with trilinear symmetry breaking.** Theumann, W.K. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34771 (INIS-BR—107, pp 81-82) **Rondom Ising model with long-range interactions.** Theumann, A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34772 (INIS-BR—107, pp 82-83) **Symmetry breaking in Potts phi^3 field theory. Crossover in random ferromagnets.** Theumann, A.; Theumann, W.K. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34773 (INIS-BR—107, pp 83-84) **Crossover in anisotropic Potts phi^3 field theory with quadratic symmetry breaking.** Theumann, W.K.; Theumann, A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34774 (INIS-BR—107, pp 84-85) **Renormalized perturbation theory for anisotropic spin systems: Crossover behavior of the susceptibility.** Theumann, W.K. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34775 **Polyacetylene: a real material linking condensed matter and field theory.** Campbell, D.K. (Theoretical Division and Center for Nonlinear Studies Los Alamos National Lab. Los Alamos, NM 87545). pp 217-228 of Structural elements in particle physics and statistical mechanics. Honerkamp, J.; Pohlmeyer, K.; Romer, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-8108108—).

From Conference on structural elements and statistical mechanics on field theory; Freiburg, F.R. Germany (31 Aug 1981).

A subject at the interface between field theory and statistical mechanics is polyacetylene (((CH) /SUB x/), a quasi-one-dimensional-organic polymer. Recent theoretical studies are reviewed in this paper. Background chemistry determines the schematic for

trans (CH) /SUB x/ . A trans (CH) /SUB x/ chain is modelled microscopically by describing the coupled motions of the lattice backbone of C-H units and the single pi-orbital electron per carbon that determines where the double bond goes. Continuum theory is focused on here. Kink and polaron nonlinear excitations, fractionally charged solitons, and confinement of kinklike solutions in cis (CH) /SUB x/ are then studied. Finally, it is shown that the continuum electron-phonon equations for trans-(CH) /SUB x/ are identical to the static, semi-classical equations of the N=2 Gross-Neveu model. Another such field theory connection involves an alternate description of kink solutons in trans (CH) /SUB x/ . The possible existence of fractionally charged solutons is touched upon in conclusion.

34776 **Self-consistent approximations beyond the CPA: Part II.** Kaplan, T.; Gray, L.J. (Solid State Division Oak Ridge National Lab. Oak Ridge, TN 37830). pp 129-146 of Excitations in disordered systems. Thorpe, M.F. New York, NY; Plenum Publishing Corp. (1982). (CONF-8109228—). Contract W-7405-ENG-26.

From NATO Advanced Study Institute conference on excitations in disordered systems; East Lansing, MI, USA (4 Sep 1981).

This paper concentrates on a self-consistent approximation for random alloys developed by Kaplan, Leath, Gray, and Diehl. The construction of the augmented space formalism for a binary alloy is sketched, and the notation to be used derived. Using the operator methods of the augmented space, the self-consistent approximation is derived for the average Green's function, and for evaluating the self-energy, taking into account the scattering by clusters of excitations. The particular cluster approximation desired is derived by treating the scattering by the excitations with S /SUB T/ exactly. Fourier transforms on the disorder-space clustersite labels solve the self-consistent set of equations. Expansion to short range order in the alloy is also discussed. A method to reduce the problem to a computationally tractable form is described.

6561 Superconductivity

REFER ALSO TO CITATION(S) 33628, 33629, 33672, 33674, 33675, 33676, 33677, 33679, 33687, 33701, 33710, 33757, 33758, 34556

34777 (LA-UR—84-430, pp 58-69) **P-state superconductivity.** Stewart, G.R.; Fisk, Z.; Willis, J.O.; Smith, J.L. 1984. NTIS, PC A05/MF A01. Order Number TI84011404.

In Los Alamos Science, Number 10, Spring 1984.

Measurements of low-temperature electrical resistance of UPt_3 to see how defect-free its crystal lattice was showed clear indications of superconductivity. Until this time no known superconductors had shown evidence of enhanced spin fluctuations and no known spin fluctuators exhibited superconductivity. The data now available refute the conventional wisdom of a dichotomy between superconductivity and a tendency toward magnetism. In UPt_3, spin fluctuations and superconductivity are known to coexist on the same electrons and at the same temperature. (GHT)

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 34558

34778 **(CNRS-CPT—82-P-1426) Localization in ν-dimensional incommensurate structures.** Bellissard, J.; Lima, R.; Scoppola, E. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751557.

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We exhibit a class of quasi periodic unbounded potential in the ν-dimensional discrete Schroedinger equation, for which the spectrum is only pure point, with exponentially localized states and a dense set of eigenvalues in R.

34779 **(CNRS-CPT—82-P-1428) Quantization of dynamical systems and stochastic control theory.** Guerra, F.; Morato, L.M. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751553.

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In the general framework of stochastic control theory we introduce a suitable form of stochastic action associated to the controlled process. Then a variational principle gives all main features of Nelson's stochastic mechanics. In particular we derive the expression of the current velocity field as the gradient of the phase action. Moreover the stochastic corrections to the Hamilton-Jacobi equation are in agreement with the quantum mechanical form of the Madelung fluid (equivalent to the Schroedinger equation). Therefore stochastic control theory can provide a very simple model simulating quantum mechanical behavior.

34780 **(FRNC-TH—1525) Ground state of charged Bose and Fermi fluids in strong coupling.** Mazighi, R. (Paris-6 Univ., 75 (France)). Mar 1982. 159p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751560.

The ground state and excited states of the charged Bose gas were studied (wave function, equation of state, thermodynamics, application of Feynman theory). The ground state of the charged Fermi gas was also investigated together with the miscibility of charged Bose and Fermi gases at 0 deg K (bosons-bosons, fermions-bosons and fermions-fermions).

34781 (INIS-mf—8921, pp 11) **Anisotropic percolation in systems of stick-like conducting particles.** Balberg, I. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number TI84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

34782 **(LBL—17840) Topics in statistical mechanics.** Elser, V. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 92p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013246.

Thesis.

This thesis deals with four independent topics in statistical mechanics: (1) the dimer problem is solved exactly for a hexagonal lattice with general boundary using a known generating function from the theory of partitions. It is shown that the leading term in the entropy depends on the shape of the boundary; (2) continuum models of percolation and self-avoiding walks are introduced with the property that their series expansions are sums over linear graphs with intrinsic combinatorial weights and explicit dimension dependence; (3) a constrained SOS model is used to describe the edge of a simple cubic crystal. Low and high temperature results are derived as well as the detailed behavior near the crystal facet; (4) the microscopic model of the λ-transition involving atomic permutation cycles is reexamined. In particular, a new derivation of the two-component field theory model of the critical behavior is presented. Results for a lattice model originally proposed by Kikuchi are extended with a high temperature series expansion and Monte Carlo simulation. 30 references.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 34748, 34981, 34993

34783 **(DOE/ER/13121—2) Resonance in weakly nonlinear systems. Progress report, August 1, 1983-March 31, 1984.** Kevorkian, J. (Washington Univ., Seattle (USA)). Apr 1984. Contract AT06-83ER13121. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013823.

Progress is reported on: adiabatic invariants; passage through resonance, a survey of results; and free-electron laser dynamics and instabilities. (GHT)

34784 **(LA-UR—84-1717) High-order sparse factorization methods for elliptic boundary value problems.** Hyman, J.M.; Manteuffel, T.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8406113—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012582.

From 5. IMACS international symposium; Bethlehem, PA, USA (19 Jun 1984).

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We are interested in solving the sparse linear systems, Av = b, that arise from finite difference or finite element approximations to partial differential equations. May iterative methods require solving an easier approximate equation, Pv = b, on each iteration. This is often called preconditioning or operator splitting [1,2,4,6-9,12-14]. The methods we consider factor A approximately into the product of an upper and lower triangular matrix P is identical to LU $\approx$ A. These methods are called incomplete LU factorization methods and their convergence rate depends on how well P approximates A. We describe some new algorithms to generate accurate LU decompositions based on the continuity of the solution v.

34785 **(PNL-SA—12095) Graphical interaction tools for multiple 2- and 3-dimensional scatterplots.** Carr, D.B.; Nicholson, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 11p. (CONF-8405194—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013250.

From 5. annual conference and exposition of the National Computer Graphics Association; Anaheim, CA, USA (13 May 1984).

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This paper discusses the use of relationships within data subsets, as viewed in marginal scatterplots, for finding and interpreting patterns in multivariate data. The data are represented by juxtaposition of scatterplots corresponding to variable pairs or triples. Subsets are defined either graphically or by the use of relational and Boolean operations on sets. Points in the same subset are linked across plots by color and symbol. The paper discusses strengths and weaknesses of exploration based on subsets linked across marginal scatterplots. Extensions to three-dimensional scatterplots are briefly indicated.

34786 **(SAND—84-0812) Some practical Runge-Kutta formulas.** Shampine, L.F. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013539.

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A new selection is made of the most practical of the many explicit Runge-Kutta formulas of order 4 which have been proposed. A new formula is considered, formulas are modified to improve their quality and efficiency in agreement with improved understanding of the issues, and formulas are derived which permit interpolation. It is possible to do a lot better than the pair of Fehlberg currently regarded as best. 21 references, 2 figures.

34787 **(SLAC/AP—22) Implicit function method for the Liouville equation.** Kheifets, S. (Stanford Linear Accelerator Center, CA (USA)). May 1984. Contract AC03-76SF00515. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013282.

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In the present short note I derive a rather general method of solving the Liouville equation. No discussion will be presented on how fast the solution can be found or how convenient the method is in practical applications. Nor any numerical calculations will be done. All these tasks can be subjects of further studies should the method become useful later.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 34840, 34844, 34967, 34967

34788 **(AD-A—137122/8) Longitudinal resistivity and intermediate Mach number collisionless transverse magnetosonic shocks. Memorandum report.** Manheimer, W.M.; Spicer, D.S. (Naval Research Lab., Washington, DC (USA)). 30 Dec 1983. 61p. (NRL-MR—5243). NTIS, PC A04/MF A01.

It is shown that for collisionless transverse magnetosonic shocks, there exists an intermediate range of Mach numbers between the maximum Mach number for transverse resistivity and the onset of significant ion reflection. In this intermediate range, the structure is dominated by a breakdown of the quasi-neutrality approximation and longitudinal resistivity is a simple fluid model for the dissipation mechanism which forms the shock.

34789 **(CONF-791240—) Nonlinear dynamics. Volume 357.** Helleman, R.H.G. (ed.). (New York Academy of Sciences, New York (USA)). 1980. 517p. New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Order Number TI84005490.

From International conference on nonlinear dynamics; New York, NY, USA (17 Dec 1979).

Separate abstracts were prepared for three of the included papers. (MOW)

34790 (CONF-791240—, pp 80-89) **Calculation of KAM surfaces.** Greene, J.M. (Princeton Univ., NJ). 1980. New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Order Number TI84005490. Contract AC02-76CH03073.

From International conference on nonlinear dynamics; New York, NY, USA (17 Dec 1979).

One of the most engaging problems in nonlinear dynamics is that of understanding how simple deterministic equations can yield apparently random solutions. Systems with this behavior appear in many of the branches of scientific endeavor. Among the simplest of these are Hamiltonian systems with a small number of degrees of freedom. The considerations that this paper deals with apply especially to two closely related types of Hamiltonians and to a more abstract conceptualization that they share. The first type of Hamiltonian depends on one coordinate and one momentum and has a periodic dependence on time. This periodicity is important for the phenomena considered here, as an implicit distinction is made between orbital information that depends on the precise number of revolutions of the time variable and that which depends only on its phase. The second of these types of Hamiltonian depends on two coordinates and two momenta, but is independent of time. Since the time variable and the conserved energy can be eliminated from the equations of motion, the orbits of this system exist in a space of the same dimensionality as that considered in the previous paragraph. The condition equivalent to the periodicity of the time variable is that the motion be bounded in the phase space. Then the orbits must be recurrent, or nearly recurrent, and periodic variables are appropriate. Only a brief review of the nature of these Hamiltonian systems is given.

34791 (CONF-791240—, pp 203-222) **Selective decay hypothesis at high mechanical and magnetic Reynolds numbers.** Matthaeus, W.H.; Montgomery, D. (College of William and Mary, Williamsburg, VA). 1980. New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Order Number TI84005490. Contract AS05-76ET53045.

From International conference on nonlinear dynamics; New York, NY, USA (17 Dec 1979).

Since 1941, turbulence theory has been dominated by attempts to prove, disprove, develop, or test experimentally and numerically certain central conjectures of Kolmogoroff and Obukhov. Virtually none of these conjectures have been established with anything like the mathematical rigor one might want, but there seems to be little doubt that they are largely accurate representations of reality. Our intention here is to show what the implications are if one generalizes one of these conjectures to two-dimensional turbulence and to magnetohydrodynamics. Certain numerical tests of the conjecture are also described. 39 references.

34792 (CONF-791240—, pp 223-235) **Plasma transport in three dimensions.** Grad, H. (New York Univ., New York). 1980. New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Order Number TI84005490. Contract AC02-76ER03077.

From International conference on nonlinear dynamics; New York, NY, USA (17 Dec 1979).

Alternating dimension formulations of plasma transport have been given for general three-dimensional plasma configurations with scalar resistivity and heat conductivity; also for general anisotropic transport coefficients in axial symmetry. These formulations are here generalized to combine arbitrary three-dimensional toroidal configurations with general anisotropic transport coefficients. All these formulations alternate marching of one-dimensional profiles with only occasional three-dimensional evaluation of plasma equilibria to obtain geometric coefficients for the one-dimensional system. The anisotropic formulation does not introduce any new geometric coefficients. Boundary conditions at the magnetic axis and at the plasma edge are briefly mentioned.

34793 **(EUR-CEA-FC—1212) Calculations of stationary solutions for the non linear viscous resistive MHD equations in slab geometry.** Edery, D. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Nov 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84751586.

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The reduced system of the non linear resistive MHD equations is used in the 2-D one helicity approximation in the numerical computations of stationary tearing modes. The critical magnetic Raynolds number S (S=tausub(r)/tausub(H) where tausub(R) and tausub(H) are respectively the characteristic resistive and hydro magnetic times) and the corresponding linear solution are computed as a starting approximation for the full non linear equations. These equations are then treated numerically by an iterative procedure which is shown to be rapidly convergent. A numerical application is given in the last part of this paper.

34794 (INIS-BR—107, pp 93) **Statistical acceleration of electrons by lower-hybrid turbulence.** Wu, C.S. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology); Gaffey Junior, J.D. (Naval Research Lab., Washington, DC (USA)); Liberman, B. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34795 (INIS-BR—107, pp 88-89) **Electrostatic instabilities and anomalous transport excited by an energetic ion beam.** Jornada, E.H. da (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Gaffey Junior, J.D. (Naval Research Lab., Washington, DC (USA)); Caponi, M.Z. (TRW System Group, Redondo Beach, CA (USA)). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34796 (INIS-BR—107, pp 86-87) **Emission of cyclotron radiation by a plasma with a tenuous component of runaway electrons.** Caldela Filho, R.A.; Schneider, R.S.; Dillenburg, D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34797 (INIS-BR—107, pp 87-88) **Electromagnetic cyclotron-loss-cone instability associated with weakly relativistic electrons.** Wong, H.K.; Wu, C.S.; Ke, F.J. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology); Schneider, R.S.; Ziebell, L.F. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34798 (INIS-BR—107, pp 89-90) **Induced electron-cyclotron emission from inhomogeneous anisotropic plasmas with electron population inversion.** Ziebell, L.F.; Dillenburg, D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34799 (INIS-BR—107, pp 90) **Momentum distribution dependence of induced electron-cyclotron emission.** Ziebell, L.F.; Dillenburg, D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34800 (INIS-BR—107, pp 94) **Wave excitation by inhomogenous suprathermal electron beams.** Freund, H.P. (Science Applications, Inc., McLean, VA (USA)); Dillenburg, D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Wu, C.S. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34801 (INIS-BR—107, pp 94-95) **Amplification of electron cyclotron radiation in non-maxwellian inhomogeneous plasmas.** Ziebell, L.F.; Dillenburg, D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780267.

In Progress Report 1981-1982 - Instituto de Fisica - Universidade Federal do Rio Grande do Sul.

34802 **(INIS-mf—8713) Fast current stiff 200 kV plasma focus (SPEED 1) - is it different from other plasma foci.** Kies, W. (Duesseldorf Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Dec 1982. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84701931.

Starting from some ideas on impedance matching, a plasma focus with extreme storage parameters is presented and compared with conventional plasma focus designs with respect to the operation characteristics and the discharge - and emission behaviour. The aim of this work is a better efficiency of the plasma focus machine (ratio of the number of neutrons produced per discharge to the energy stores Y/Wo). With the realisation of the SPEED 1 experiment an instrument is available which extends the parameter region of focus machines appreciably. The (limiting) opeartion parameters are: 20(30) kJ stored energy, 160(200)kV charging voltage, current increase $> 5x10^{12}$ A/s, current rise time 400 nsec, discharge current 0.9(1.1) MA, battery impedance 160 mΩ. (orig./HT).

34803 **(INIS-mf—8734) Studies on the behaviour of neutral particles in a tokamak plasma.** Ritter, G. (Duesseldorf Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 19 Jul 1982. 161p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84701932.

The presence of neutral particles allows for some new methods of plasma diagnostics. The ion temperature can be determined indirectly by spectroscopic measurements and an energy analysis of the neutral particles in the wall region. In addition the particle flux, the electron density and the plasma position can be controlled, as is demonstrated in this work. Based on a plasma confinement experiment of the tokamak type (UNITOR) the neutral particle behaviour has been studied theoretically and experimentally. The relevant processes in the plasma and at the wall are studied to estimate their relative importance. Several techniques are presented for the solution of the Boltzmann equation, which is used to describe the neu-

tral particles: integral iteration methods and Monte Carlo schemes. (orig./HT).

34804 (INIS-mf—8957) Mass spectrometer diagnostic technique in the study of stationary afterglow plasmas in helium, argon and krypton. Langenwalter, M. (Innsbruck Univ. (Austria)). 1979. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780392.

Since some years the method of massspectrometric monitoring has become an important tool in the analysis of time resolved (or stationary) afterglow plasmas. The present thesis reports the construction and testing of a new fully bakeable UHV-stationary-afterglow-apparatus using a hollow cathode discharge as plasma source for the first time. The hollow cathode is moveable perpendicular to its axis relative to the sampling orifice (i.e. a very small hole at the centre of the plasma container's boundary), so that the radical distribution of the charged particle density can be studied. Several specific extraction conditions for ions from the plasma especially the sampling probe potential have been systematically investigated. Results are illustrated and discussed. The new apparatus has been tested by determining the ambipolar diffusion coefficient of the molecular ion He_2^+ in a pure Helium-plasma in thermal equilibrium. The present result (Dsub(a2) = 603 +- 38 / P_0 cm^2s^{-1}) is in agreement with results reported by other workers. Finally an example for the radial behaviour of the Ar^+-sampling current in an Argon-discharge for several different times in the afterglow period is given. The shown behaviour agrees relatively well with the theoretically predicted radial ion density distribution, i.e. the zero-order Ressel'function. (Author).

34805 (INIS-mf—8959) Boltzmann collision term and energy transfer in a stationary two-component plasma. Riedler, J.M. (Technische Univ., Graz (Austria)). 1982. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780393.

The problem considered is the feasibility of unconventional - other than Tokamak - fusion methods: driven plasma and DD or p + $B^{11} \rightarrow 3\ He^4$ reactions. A necessary condition is that the energy loss rate from the injected ion beam to the plasma should be smaller than the power generated. In the introduction the energy loss mechanism are enumerated Part I is concerned with the derivation and solution of a Boltzmann equation appropriate to the problem. At the end of this part the reasons are discussed why the attempt at the solution failed. Apparently because of lack of time this sophisticated method is abandoned and simpler methods are used in Part II. An estimation of the energy transfer rate is made and a result identical to that of Glasstone-Lovberg is obtained. A parametrical study with emphasis of the He^3 semicatalysed DD reaction is undertaken. One conclusion is that the assumption of Tsub(e) = 1/10 Tsub(i) gives only for the latter reaction a power ratio of 0724 < 1 at Tsub(i) = 1000keV and Tsub(e) = 100keV. The other conclusion is that kTsub(i) approximately kTsub(e) should be fulfilled (i.e. thermal equilibrium) in order that the energy taken away by the ions disappearing through the loss cone should be smaller than the fusion energy generated. (G.Q.).

34806 (INIS-mf—8960) Integration theory of the inhomogenous Fokker-Planck equation using certain orthogonal systems. Sgouridis, S. (Technische Univ., Graz (Austria)). 1982. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780394.

Starting from the stochastic probability distribution of particles in a plasma a general Fokker-Planck (FP) equation is rederived for the Coulomb case and point fusion reactor model conditions. Following Rosenbluth et al. Phys. Rev. 107(1),1957 an appropriate collision term and a corresponding transport (FP) equation is obtained and transformed for special cases and different coordinates. Sonine polynomials, an orthogonal set of functions separable in time and velocity is put forward for the solution of this kind of equations, the method being series expansion in Sonine polynomials around the equilibrium Maxwellian distribution. To familiarise with the technique is applied to a series of problems of rising complexity. Boltzmann equation, one-dimensional FP equation, culiminating in the two-dimensional (axial symmetry). FP equation with a loss cone and source terms. This nonhomogenious and non-stationary equation is converted into an infinite system of equations which in practice must be evaluated numerically by successive approximations. (G.Q.).

34807 (INIS-SU—202, pp 121-135) Main physical and technological problems of construction of a tokamak with a strong magnetic field and plasma adiabatic compression. Glukhikh, V.A.; Karasev, B.G.; Krylov, V.A. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Technological problems of construction of a tokamak with a strong magnetic field and adiabatic plasma compression are considered. The results of sketch designing of the installation with the following parameters are presented: large filament radius after compression-0,415 m, small filament radius after compression-0,125 m, plasma current after two compressions up to 1,2 MA, mean plasma density upon two compressions up to 10^{15} cm^{-3}, average plasma temperature upon compressions 7 keV, energy confinement time 30-100 ms. The toroidal field winding consist of 32 single-twin sections. Each section represents a massive twin of chromous bronze enclosed in a steel bandage. Maximum winding current is 830 kA, maximum magnetic field on the winding surface 21,2 T. A poloidal field is formed without using ferromagnetic core by means of inductor winding, compression winding, two equilibrium windings and two initial fiel, correction windings. The parameters of the power supply system of the toroidal field winding, inductor supply system and compression winding, equilibrium winding supply system, generak power supply system are given. Nowadays different versions of the metallic chamber design without cuts are studied.

34808 (INIS-SU—202, pp 173-180) Optimization of an electrodynamic acceleration system and characteristics of a liner in the "torus-liner"thermonuclear scheme with quasispherical compression. Es'koV, A.G.; Kurtmullaev, R.Kh.; Kitaev, M.I.; Semenov, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Kozlov, N.P.; Khvesyuk, V.I.; Yaminskij, A.V. (Moskovskoe Vysshee Tekhnicheskoe Uchilishche (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Experimental and numerical investigations of the thermonuclear system "torus-linear" (TL) are presented. Main TL features are a quasispherical form of a heavy shell and closed magnetic configuration in its cavity. TL consists of three functional parts: shaping chamber and compact torus heating, transport channel with coils for creating a leading field, acceleration and liner compression system comprising a multitime pushing coil capacitance storage with commutators and low-inductive current guide, profiled liner and toroid capture coils in the liner chamber. As a result of the experiment quasispherical closed cavity shaping is reached after face collapse in 20 μs with cavity 2,5 x 10^5 cm/ rate. The plasma toroid has been replaced from the shaping chamber through the transport channel into the liner chamber without noticeable energy and magnetic flux losses and captured in the linear chamber. The dependences of electrodynamic acceleration system efficiency and compression coefficients on initial plasma pressure for battery energies 2 x 10^5 and 6 x 10^5 J. Are given oscillograms of the pushing field in the liner-coil gap and total acceleration system current are given. The calculation is in perfect agreement with the experiment.

34809 (INIS-SU—202, pp 247-251) High-velocity dense plasma production at high carrying out currents. Komel'kov, V.S.; Perebejnos, V.V.; Solomonov, M.T. (Gosudarstvennyj Nauchno-Issledovatel'skij Ehnergeticheskij Inst., Moscow (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

For the purpose of obtaining dense high-temperature plasma the process of plasma motion in an accelerator where plasma jets of

"spouting" pinch type are formed is considered. The process when acceleration inside the mozzle related to gas raking is presented as an accessory process. The latter is required for current increase in the discharge while the main process accompanied by mass drop and velocity jump occurs out side the mozzle in the working chamber. The accelerator and the chamber have been filled with hydrogen under pressure of 100 tor. The central shorter tantalum electrode represents a rod of 10 mm diameter the outer stainless steel electrode has an internal diameter of 40 mm. The discharge has been ignited at a certain distance from the insulator and propagated in the form of a continuous plasma piston along the electrodes of 240 mm length. The discharge current equals 1400 kA. The typical longitudinal photoscanning of plasma bunch motion outside the nozzle is given. Maximum plasma bunch velocity has reached 1.7×10^7 cm/c. The pointed out effects of mass drop and the presenece of intraplasma magnetic insulation open the prospects of obtaining high temperature plasma flows with 10^{19}-10^{21} cm^{-3} densities.

34810 (INIS-SU—202, pp 252-259) **Spread of a plasma sheath with a current.** Komel'kov, V.S.; Kuznetsov, A.P.; Perebenos, V.V.; Pleshanov, A.S.; Solomonov, M.T. (Gosudarstvennyj Nauchno-Issledovatel'skij Ehnergeticheskij Inst., Moscow (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of theoretical and experimental investigation of spread plasma sheath with a current are presented. The plasma bunch has been generated by the coaxial pulse accelerator. It is shown that the hydrogen plasma motion in the near-axial region leads to a stationary regime, energy "pumping" into plasma bunch is realized with a constant velocity. The calculation results point out to the real possibility of using plasma accelerators for plasma speeding-up to very high parameters behind the accelerators section. In case of taking into consideration the regimes with discharge current high values the estimation of front velocity values and flow rate values can be obtained by multiplication by 2 of the corresponding values measured in the accelerator coaxial. The temperature estimation is obtained by multiplication of the value of plasma temperature in the accelerator by the number proximate to 3, density estimation is reduced to multiplication by 2 of gas density in the accelerator before to the discharge. As to pressure it practically remains the same as it has been in gas compressed inside the accelerator.

34811 (INIS-SU—202, pp 260-267) **Plasma acceleration in the maximum of a discharge circuit current.** Komel'kov, V.S.; Petrushchenko, G.Yu. (Gosudarstvennyj Nauchno-Issledovatel'skij Ehnergeticheskij Inst., Moscow (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Theoretical investigations of plasma motion outside coaxial accelerator nozzle with plasma sheath and current filament are reported. Estimations of plasma acceleration in the maximum of a discharge circuit current are given. The conclusion is drawn that if in the plasma acceleration process the movable plasma bunch mass drop exists plasma acceleration becomes possible in the regime when a discharge current is close to its maximum value. It is advantageous to raise the value of a discharge circuit induction as this contributes to reaching higher plasma velocities as well as increasing of duration of high velocity plasma flows existence.

34812 (INIS-SU—202, pp 481-488) **High-current ion beam production in a plasma-filled triode.** Arbuzov, A.I.; Bystritski, V.M.; Didenko, A.N.; Petrov, A.V. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

With the purpose of investigating the possibility of increasing the beam intensity at the thermonuclear installation target intense ion beam (IIB) production in a plasma-filled triode theoretically and experimentally has been studied. The triode anode performed in the form of a metalic ring of 180 mm diameter on which a tungsten grid with 75% transparance has been placed between two grid cathodes of 100 mm diameter. The triode has been placed in the longitudinal magnetic field up to 3 kE. Plasma produced by the coaxial plasma gun with a pulse gas leak-in (lH_2,D_2,N_2,He) filled accelerating triode gaps through one of grid cathodes. The plasma flow velocity constituted $(2\text{-}4) \times 10^6$ cm/s at plasma concentration up to 10^{14} cm^{-3}. The IIB current density at the distance of 8 cm. of the cathode for protons constituted 68 A/cm^2 at the distance of 31,5 cm for protons 41 A/cm^2 deuterons 24 A/cm^2 nitrogen ions 12 A/cm^2. IIB production efficiency attained 25%. It is concluded that the plasma-filled triode can be used for IIB production with atomic number > 1.

34813 (INIS-SU—202, pp 372-379) **Linear theta pinch devices with a fast rising magnetic field for dense plasma heating.** Burtsev, V.A.; Guad, C.A.; Zheltov, V.A.; Zhukov, A.P.; Kalinin, N.V.; Kozhevin, V.M.; Leonov, S.A.; Litunovskij, V.N.; Ovsyannikov, V.A. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The experimental results of studying mega-ampere currents commutation in electric circuits of the theta-pinch device UTRO with induction-capacitance energy storage of 1,1 MJ power are presented. As current breakers foil releases are used. A solenoid of 50 cm length and diameter 7 cm has been inductive charge. In experiments the breaking capacity level 0,5 TW has been reached which permits to create in the solenoid magnetic fields with 60 kGs induction and rising time 0,5 μs. On the basis of the data obtained the possibility of designing the UTRO-M device for studying possibilities of optimum combination of different methods of dense plasma heating including using CO_2-laser power radiation is considered. Numerical simulation data have shown the possibility of increasing the device efficiency up to some percent at optimum release parameters. The methods of increasing the temperature of plasma and neutron yield based on programming initial profile of plasma density and generation of colliding shock waves are proposed.

34814 (INIS-SU—219, pp 39-45) **Megagauss magnetic field production and eValuation of their application for dense plasma confinement in a linear theta-pinch reactor.** Bocharov, Yu.N.; Krivosheev, S.I.; Kruchinin, A.I.; Chechel', A.N.; Shneerson, G.A.; Shutov, V.L. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Estimations of the plasma confinement time, taU, in a single turn megagauss solenoid defined by the field diffusion into plasma and solenoid walls and by the solenoid expansion under the action of magnetic pressure, heating of the solenoid walls and plasma radiation. The solenoid expansion is shown to be the main factor defining tau. The results are presented of experimental investigation into the deformation of thin-walled turns of small diameter in the magnetic field with the induction amplitude up to 390 T. The results also show the possibility of plasma confinement in small-sized solenoids with the magnetic field of about 400 T during a period corresponding to the Lawson criterion of 10^{13} cm^{-3} at the 10 keV plasma temperature.

34815 (INIS-SU—219, pp 54-60) **Probe measurements of the magnetic field structure of toroidal eigenmodes in the Texas Tech Tokamak.** Coleman, P.D.; Kuistiansen, M.; Hagler, M.O. (Texas Tech Univ., Lubbock (USA). Dept. of Electrical Engineering); Blackwell, B.D. (Massachusetts Inst. of Tech., Cambridge (USA). Francis Bitter National Magnet Lab.). 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Magnetic probes, covered by protective sheaths, were used to make detailed measurements of the field structure of fast Alfven wave toroidal eigenmodes in the Texas Tech Tokamak. Rods of alumina, Macor, quartz and boron nitride were inserted into the plasma to determine the feasibility of using these materials as protective sheaths. Results indicate that alumina, Macor, and quartz are unacceptable as sheath materials. Boron nitride, however, survived the plasma environment without affecting the plasma parameters too seriously and without serious material ablation or damage. It was hence used as a protective probe sheath. Radial scans of the z and THETC components of the fast waves magnetic field structure have been made using these boron nitride sheaths for protection of the probes.

34816 **(IPP—2/252) Fast plasma tomography routine with second-order accuracy and compensation for spatial resolution.** Smeulders, P. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jul 1983. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751431.

If the rotation of the mode structures in front of an X-ray pinhole camera is known, the full cross-section of the structures can be obtained. Where various modes are observed simultaneously, the experimental well-established phase coupling of these modes is implied. This allows the transition from time to poloidal angle to be made and modes with different toroidal mode numbers to be separated. With one pinhole camera, however, it is not possible to separate more than two modes with different poloidal mode numbers. In the first sections the computer code is described; examples of various tearing modes measured in a current-carrying stellarator plasma are then presented. The time evolution and the structure of these modes is discussed.

34817 **(LA—10020-MS) Toroidal equilibrium in an iron-core reversed field pinch.** Miller, G. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013858.

An analytical theory of toroidal equilibrium in the ZT-40M reversed field pinch is obtained, including effects of iron cores and resistive shell. The iron cores alter the form of the equilibrium condition and cause the equilibrium to be unstable on the shell resistive time scale.

34818 **(LA—10029-MS) Thermal instabilities in the edge region of reversed-field pinches.** Goedert, J.; Mondt, J.P. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013861.

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Thermal stability of the edge region of reversed-field pinch configurations is analyzed within the context of a two-fluid model. Two major sources of instability are identified in combination with a parallel electric field: either an electron temperature gradient and/or a density gradient that leads to rapid growth (of several to many ohmic heating rates) over a region of several millimeters around the mode-rational surfaces in the edge region. The basic signature of both instabilities is electrostatic. In the case of the density gradient mode, the signature relies on the effects of electron compressibility, whereas the temperature gradient mode can be identified as the current-convective instability by taking the limit of zero diamagnetic drift, density gradient, thermal force, drift heat flux, and electron compressibility.

34819 **(LA—10065-MS) Compton scattering of photons from electrons in thermal (Maxwellian) motion: electron heating.** Devaney, J.J. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013860.

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The Compton differential scattering of photons from a relativistic Maxwell distribution of electrons is reviewed. The exact theory and the approximate theories due to Wienke and Lathrop were verified for application to particle transport codes. We find that the ordinary (zero temperature) Klein-Nishina formula can be used up to electron temperatures of 10 keV if errors of less than 1.6% in the total cross section and of about 5% or less in the differential cross section can be tolerated. Ohterwise, for photons below 1 MeV and temperatures below 100 keV the Wienke-Lathrop isotropic approximation is recommended. Were it not for the four integrations effectively required to use the exact theory, it would be recommended. An approximate (Cooper and Cummings), simple, accurate, total cross section as a function of photon energy and electron temperature is presented.

34820 **(LA—10084-MS-Vol.1) Compilation of interim technical research memoranda. Volume I.** Shanahan, W.R. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014139.

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Four interim technical research memoranda are presented that describe the results of numerical simulations designed to investigate the dynamics of energetic plasma beams propagating across magnetic fields.

34821 **(ORNL/TM—9015) Electron transport in EBT in the low collision frequency limit.** Hastings, D.E. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 90p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013601.

A variational principle formulation is used to calculate the electron neoclassical transport coefficients in a bumpy torus for the low collisionality regime. The electron radial drift is calculated as a function of the plasma position and the poloidal electric field which is determined self-consistently. A bounce-averaged differential collision operator is used and the results are compared to previous treatments using a BGK operator.

34822 **(ORNL/TM—9075) Propagation and absorption of electromagnetic waves in fully relativistic plasmas.** Batchelor, D.B.; Goldfinger, R.C.; Weitzner, H. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 44p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013627.

The propagation and absorption of electromagnetic waves in a relativistic Maxwellian plasma are investigated by solving the uniform plasma dispersion relation. Both the Hermitian and the anti-Hermitian parts of the plasma conductivity tensor σ are calculated relativistically. The Bessel functions occurring in σ are not expanded, and many cyclotron harmonic terms are included at high temperatures. The dispersion relation is solved numerically for perpendicular propagation, k/sub parallel to/ = 0, where the relativistic effects are maximum and are not masked by Doppler broadening, which has been more thoroughly investigated. It is found that relativistic broadening has a substantial effect on wave dispersion, shifting the extraordinary mode right-hand cutoff and the upper hybrid resonance to a higher magnetic field with increasing temperature. Above a critical temperature the cutoff disappears entirely. There is a broad range of temperatures, 20 keV $\leq$ T/sub e/ $\leq$ 500 keV, for which the wave number k/sub perpendicular/ to differs significantly from both the cold plasma value and the vacuum value. This has important implications for ray tracing in relativistic plasmas. Wave damping rates are calculated and compared to results from a previous formulation using the Poynting theorem, in which only the Hermitian part of σ is calculated relativistically.

34823 **(ORNL/TM—9127) Reliability of initial-value MHD calculations of tokamak disruptions.** Hicks, H.R.; Carreras, B.A.; Garcia, L.; Holmes, J.A. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013600.

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We have proposed the nonlinear coupling of resistive tearing modes as the mechanism for some tokamak disruptions. This is based primarily on initial-value resistive magnetohydrodynamic cal-

culations performed with a finite-difference grid in minor radius and Fourier series expansion in the poloidal and toroidal angles. The calculations show that, for certain q profiles, the nonlinear interaction of tearing modes of different helicities leads to the rapid destabilization of other modes. The resulting effects and the time scale are consistent with the tokamak disruption.

34824 **(ORNL/TM—9133) Accelerated convergence of the steepest-descent method for magnetohydrodynamic equilibria.** Handy, C.R.; Hirshman, S.P. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013602.

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Iterative schemes based on the method of steepest descent have recently been used to obtain magnetohydrodynamic (MHD) equilibria. Such schemes generate asymptotic geometric vector sequences whose convergence rate can be improved through the use of the ϵ-algorithm. The application of this nonlinear recursive technique to stiff systems is discussed. In principle, the ϵ-algorithm is capable of yielding quadratic convergence and therefore represents an attractive alternative to other quadratic convergence schemes requiring Jacobian matrix inversion. Because the damped MHD equations have eigenvalues with negative real parts (in the neighborhood of a stable equilibrium), the ϵ-algorithm will generally be stable. Concern for residual monotonic sequences leads to consideration of alternative methods for implementing the algorithm.

34825 **(PPPL—2106) Recent results from TFTR.** Hawryluk, R.J.; Bell, M.G.; Bitter, M.; Blanchard, W.R.; Bretz, N.; Bush, C.; Cecchi, J.L.; Cohen, S.; Coonrod, J.; Davis, S.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1984. Contract AC02-76CH03073. 34p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013100.

During the past year, the research activities on TFTR have encompassed three broad areas. The first was to extend the operating range of TFTR. Plasma currents up to 1.5 MA were achieved in discharges with a = 0.83 m, R = 2.55 m at a toroidal field of 2.7 T. In these large plasmas, the maximum line average density was 3.35 x 10^{19} m^{-3}. The second activity was a study of the scaling of the energy confinement time, tau/sub E/, in ohmically heated discharges as a function of plasma current, density, and plasma size. These experiments indicate a favorable scaling of tau/sub E/ with size and density. Energy confinement times in excess of 0.25 s were obtained in deuterium discharges. The third activity was a study of adiabatic compression. During compression, the plasma current and ion temperature scaled approximately as predicted; however, the electron temperature and density scaled less strongly than predicted for ideal compression.

34826 **(PPPL—2107) High-n ideal and resistive shear Alfven waves in tokamaks.** Cheng, C.Z.; Chen, L.; Chance, M.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1984. Contract AC02-76CH03073. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013099.

Ideal and resistive MHD equations for the shear Alfven waves are studied in a low-β toroidal model by employing the high-n ballooning formalism. The ion sound effects are neglected. For an infinite shear slab, the ideal MHD model gives rise to a continuous spectrum of real frequencies and discrete eigenmodes (Alfven-Landau modes) with complex frequencies. With toroidal coupling effects due to nonuniform toroidal magnetic field, the continuum is broken up into small continuum bands and new discrete toroidal eigenmodes can exist inside the continuum gaps. Unstable ballooning eigenmodes are also introduced by the bad curvature when $\beta > \beta$/sub c/. The resistivity (n) can be considered perturbatively for the ideal modes. In addition, four branches of resistive modes are induced by the resistivity: (1) Resistive entropy modes which are stable ($\Delta' < 0$) with frequencies approaching zero as n/sup 3/5/, (3) Resistive periodic shear Alfven waves which approach the finite frequency end points of the continuum bands and n/sup 1/2, and (4) Resistive ballooning modes which are purely growing with growth rate proportional to eta/sup 1/3/β/sup 2/3/ as eta $\rightarrow$ O and $\beta \rightarrow$ O.

34827 **(PPPL—2108) Conductivity of rf-heated plasma.** Fisch, N.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1984. Contract AC02-76CH03073. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013088.

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The electron velocity distribution of rf-heated plasma may be so far from Maxwellian that Spitzer conductivity no longer holds. A new conductivity for such plasmas is derived and the result can be put in a remarkably general form. The new expression should be of great practical value in examining schemes for current ramp-up in tokamaks by means of lower-hybrid or other waves.

34828 **(PPPL—2110) New fluctuation phenomena in the H-mode regime of PDX tokamak plasmas.** Slusher, R.E.; Surko, C.M.; Valley, J.F.; Crowley, T.; Mazzucato, E.; McGuire, K. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Bell Labs., Murray Hill, NJ (USA)). May 1984. Contract AC02-76CH03073. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013684.

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A new kind of quasi-coherent fluctuation is observed near the edge of plasmas in the PDX tokamak during H-mode operation. (The H-mode occurs in neutral beam heated divertor plasmas and is characterized by improved energy containment as well as large density and temperature gradients near the plasma edge.) These fluctuations are evidenced as VUV and density fluctuation bursts at well-defined frequencies ($\Delta\omega/\omega \leqq 0.1$) in the frequency range between 50 and 180 kHz. They affect the edge temperature-density product, and therefore they may be important for understanding the relationship between the large edge density and temperature gradients and the improved energy confinement.

34829 **(SAI—84/1628-PRI-79) Finite poloidal gyroradii effects on tokamak transport.** Catto, P.J. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Jun 1984. Contract AC03-76ET53057. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012675.

A gyrokinetic equation is derived which treats the E x B drift in the poloidal magnetic field as the same order as the species thermal speed. This equation along with quasi-neutrality permit a self-consistent treatment of the poloidal variation of the electrostatic potential which becomes important at finite poloidal gyroradii. A plateau regime calculation is presented to illustrate how the modifications to the transport can be evaluated explicitly.

34830 **(UCRL-Trans—11970) Probing a plasma with high-energy beams of atoms using threshold detectors.** Bocharov, V.N.; Konstantinov, S.G.; Kudryavtsev, A.M.; Myskin, O.K.; Panasyuk, V.M.; Tsel'nik, F.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. Translation of ; Novosibirsk Preprint, 1982. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013360.

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A method is described for a significant increase (to 10^4) of the signal/noise ratio during active corpuscular diagnostics of plasma by using a high-energy (to 80 keV) beam of helium atoms and a system of silicon semiconductor detectors with low registration threshold, ~ 15 keV. Amplification factors of detectors in the 10 to 70 keV range were measured, and the results of measurements of the radial profile of density and potential of a spinning plasma are given.

34831 **(UCRL-Trans—11972) Protective plasma envelope.** Bocharov, V.N.; Konstantinov, S.G.; Kudryavtsev, A.M.; Myskin, O.K.; Panasyuk, V.M.; Tsel'nik, F.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. Translation of ; Novosibirsk Preprint 83-77, 1983. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013316.

A method of creating an annular plasma envelope used to protect the hot plasma from flows of impurities and gases from the

walls of the vacuum chamber is described. The diameter of the envelope is 30 cm, the thickness of the wall is 1.5 cm, the length is 2.5 m, and its density is from 10^{13} to 10^{14} cm^{-3}. The envelope attenuates the incident (from outside) flow of helium 10-fold and the low of hydrogen 20-fold.

34832 **(UCRL-Trans—11971) Transverse ion losses through the outer plugs of an ambipolar trap under conditions of few collisions.** Pekker, L.S.; Stupakov, G.V. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. Translation of ; Novosibirsk Preprint 81-95, 1981. 32p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013315.

Qualitative estimates are given for the rate of losses in a regime of low collisions and indicate conditions of its applicability. The exact expressions for the flow of ions from the trap are described.

34833 **(UCRL-Trans—11973) Influence of the finite Larmor radius effect on plasma equilibrium.** Stupakov, G.V. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. C;Institute of Nuclear Physics of the Academy of Sciences, USSR, Novosibirsk, Preprint 84-15. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013363.

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Equilibria of a small β plasma immersed in a magnetic field with parallel straight lines of force are considered. It is shown that finite ion Larmor radius effects (in hydrodynamical description of plasma these effects correspond to accounting for collisionless ion viscosity and ion inertia), even being small, considerably reduce the class of possible equilibrium configurations predicted by the usual MHD model. The microscopic origin of the effect is due to the ion drifts appearing in high (third) orders of drift theory. Relevance of this effect to magnetic traps is briefly discussed.

34834 **Quantitative comparison of experimental and theoretical growth rates of the positional instability in Doublet III.** Yokomizo, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); McClain, F.W.; Jensen, T.H. (GA Technologies, Inc., San Diego, CA (USA)). *Nuclear Fusion;* **23**: No. 12, 1593-1598(Dec 1983).

Experimentally measured growth rates of the positional instability of vertically elongated plasmas in Doublet III are compared with those obtained from a numerical code based on linear perturbation theory. The relevant elements of the circumstances of the experiment have been included in the code. The perturbations of plasma currents and currents in the wall of the vacuum vessel as well as in the coils surrounding the plasma are included in the model. The modelling of the complicated external circuitry of the coils is based on a simple assumption which was supported by observation. Comparison of the measured growth rates with those calculated suggests that the essential phenomena are adequately described by the model.

34835 **Comment on the calculation of Tsub(e) from Thomson scattering data.** Lazarus, E.A. (Oak Ridge National Lab., TN (USA)). *Plasma Physics;* **25**: No. 11, 1271-1273(Nov 1983).

Short communication.

34836 **Retarded time superposition principle and the relativistic collision operator.** Hizanidis, K.; Molvig, K.; Swartz, K. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). *Journal of Plasma Physics;* **30**: 223-248(Oct 1983).

A retarded time superposition principle is formulated and proved for the two-particle correlation function in a multi-species relativistic, and fully electro-magnetic, plasma. This principle is used to obtain the relativistic collision operator.

34837 **Guided modes between upper-hybrid and plasma resonance.** Morales, G.J.; Maggs, J.E. (California Univ., Los Angeles (USA). Dept. of Physics). *Journal of Plasma Physics;* **30**: 267-274(Oct 1983).

The structure of driven electrostatic oscillations is determined for a cold plasma with a zero-order density gradient along the magnetic field. A set of well-behaved structures, bounded at plasma resonance, exists for discrete values of the perpendicular wavenumber. A Green's function suitable for sources located in the overdense region of the plasma is constructed. The driven medium responds as a loss free guide.

34838 **Relaxation processes and persistence of stability in finite β plasmas.** Coppi, B.; Crew, G.B.; Ramos, J.J. (Massachusetts Inst. of Tech., Cambridge (USA)). *Comments on Plasma Physics and Controlled Fusion;* **8**: No. 1, 11-22(Jul 1983).

Fusion burn conditions can be attained through a heating sequence of finite β plasma equilibrium configurations that preserves magnetic flux and macroscopic (ideal MHD) stability. This condition can then be maintained as the heating phase is completed and the achieved equilibrium configuration relaxes, due to the effects of finite electrical resistivity, toward states in which the rationalized rotational transform, is larger than unity over a considerable portion of the plasma column. In fact, both ballooning and internal ($m^o = 1$) kink modes exhibit a "second stability" region in the relevant parameter space.

34839 **Numerical analysis of the Boltzmann equation including Fokker-Planck terms.** Przybylski, K.; Lizou, J. (Institut de Genie Atomique, Ecole Polytechnique Federale de Lausanne EPFL-Ecublens, CH-1015 Lausanne). *Nuclear Science and Engineering;* **81**: No. 1, 92-109(May 1982).

After a short presentation of the Boltzmann-Fokker-Planck (BFP) equation, which was derived in a previous work, two numerical approaches to solve this equation are investigated--the multigroup method and a diamond scheme applied in a consistent way to space and energy variables. Because of the parabolic nature of the Fokker-Planck operator, it is shown that the standard neutron transport codes cannot solve such an equation. With the one-dimensional time-dependent BFP-1 code, many numerical results have been produced. All deal with the transport of charged particles in dense plasmas because such a problem is very severe from a numerical point of view. Other applications can be imagined since the BFP formalism is quite general.

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REFER ALSO TO CITATION(S) 32624, 33492, 33625, 33630, 33703, 33704, 33705, 33706, 33725, 33726, 33860, 33879, 33967

34840 **(CEA-CONF—7088) Experimental study of heavy ion beam interaction with a CO_2 laser produced plasma.** Dei-Cas, R.; Bardy, J.; Beuve, M.A.; Laget, J.P.; Menier, A.; Renaud, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Sep 1983. 39p. (In French). (CONF-8309242—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751575.

From Meeting of the French Society of Physics; Grenobel, France (19 Sep 1983).

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This experiment is being installed at Bruyeres-le-Chatel CEA. In this article, experimental device is described and principal technical and physical constraints to respect for taking up experiments in the following fields are analysed: the ionization state study of a heavy ion beam through a plasma; the heavy ion slowing-down study in a light or heavy plasma; the ionization study of the plasma itself with the help of a probe beam technique.

34841 **(CONF-840520—8) Synergistic effects in plasma surface interactions.** Roberto, J.B.; Behrisch, R. (Oak Ridge National Lab., TN (USA); Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). 1984. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84012346.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The possible synergistic effects which can contribute to plasma surface interaction phenomena in fusion devices are re-

viewed. These effects include the influence of reactive ions, surface modification, temperature, radiation damage, and external forces and fields on erosion yields, hydrogen retention and release, and other surface processes. The important synergistic effects are described in terms of surface and edge conditions encountered in present fusion devices and expected in future reactors. Priority data needs include the chemical erosion of graphite at high particle fluxes, melt-layer stability under disruption-induced eddy current forces, the influence of bulk neutron damage on hydrogen retention, and an in-situ evaluation of synergistic effects in operating fusion devices.

34842 **(DOE/ER—0113/3) Sixth annual progress report on special purpose materials for magnetically confined fusion reactors.** (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84011825.

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Separate abstracts were prepared for eleven of the included sections. (MOW)

34843 **(DOE/ER/10846—T2) Research and development of a plasma jet mass accelerator as a driver for impact fusion. Final report.** Goldstein, S.A.; Tidman, D.A.; Burton, R.L.; Massey, D.W.; Winsor, N.K. (GT-Devices, Alexandria, VA (USA)). 13 Jun 1984. Contract AC05-81ER10846. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84012940.

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A Ten Module Accelerator has been designed, fabricated and tested at projectile velocities up to 5 km/sec. It has been shown that a projectile with mass less than a half gram can be accelerated by a succession of momentum kicks from plasma jets. The significance of this acceleration mechanism is that it can be used, in principle, to accelerate projectiles to several hundred kilometers per second as a driver for inertial fusion or other energy-related applications. A theoretical base has been developed to understand the physics of plasma jet generation and the coupling of the jet momentum to the projectile.

34844 **(FRNC-TH—1364) Electron density interferometry measurement in laser-matter interaction.** Popovics-Chenais, C. (Paris-11 Univ., 91 - Orsay (France)). May 1981. 172p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751579.

This work is concerned with the laser-interferometry measurement of the electronic density in the corona and the conduction zone external part. Particularly, it is aimed at showing up density gradients and at their space-xime localization. The first chapter recalls the density profile influence on the absorption principal mechanisms and the laser energy transport. In chapter two, the numerical and analytical hydrodynamic models describing the density profile are analysed. The influence on the density profile of the ponderomotive force associated to high oscillating electric fields is studied, together with the limited thermal conduction and suprathermal electron population. The mechanism action, in our measurement conditions, is numerically simulated. Calculations are made with experimental parameters. The measurement interaction conditions, together with the diagnostic method by high resolution laser interferometry are detailed. The results are analysed with the help of numerical simulation which is the experiment modeling. An overview of the mechanisms shown up by interferometric measurements and their correlation with other diagnostics is the conclusion of this work.

34845 **(GA-A—17151) GA effort of the DOE 12 Tesla Coil Development Program. Progress report, 1983.** Alcorn, J.S. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-84ER53158. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013657.

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This report covers the FY 83 effort of the GA 12 Tesla Coil Development Program. During the course of this six-year program, Team One (GA/MCA/University of Wisconsin) has developed a generic concept for a 10 to 12 tesla tokamak toroidal field coil system, employing cabled NbTi/Cu conductor, bath-cooled with superfluid helium at 1.8 K. Following a conductor development effort (FY 79, 80), a 40-cm bore coil/cryostat unit was constructed, using conductor/support/cooling features prototypical of those envisioned for full-scale TF-coils. This was delivered to LLNL in September 1983, for testing within the LLNL High Field Test Facility (TFTF) during FY 84. This report describes the test coil, and its fabrication. Included are facsimiles of the fabrication drawings, and procedures for testing in the LLNL HFTF.

34846 **(GA-A—17377) Doublet III ac power systems.** Varga, H.; Cowles, C.; Overett, T.; Unmack, F. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 7p. (CONF-831203—159). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012961.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Doublet III is a magnetic confinement fusion experiment using the Tokamak plasma confinement configuration. Plasma experiments started early in 1978. In the succeeding five years, the demand for additional electrical power has increased as various elements have been added to the original Doublet III device, including neutral beam heating and additional plasma control power supplies. Doublett III is a pulsed device, with a repetition rate of one pulse per five minutes. The ac power is provided by a combination of utility supply systems and from Doublet III energy storage generators. The system incorporates special features to provide a high degree of flexibility and redundancy.

34847 **(GA-A—17378) Performance analysis of 180° reflection magnet in Doublet III neutral beamline.** Hong, R.; Colleraine, A.P.; Kamperschroer, J.H.; Kim, J.; Treglio, J.R. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—160). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012958.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The beam power transmission and deposition in the bending magnet region of the Doublet III neutral injection beamline are examined. Two effects are investigated: the change in power transmitted through the magnet with the calorimeter in and out of the beamline, and the lack of ion power returning to the ion dump. It will be shown that gas evolving and reflecting from the calorimeter raises the gas pressure in the magnet gap to produce charge exchange losses resulting in ~ 13% decrease in neutral beam power passing through the gap. It has also been determined that the missing ion power is deposited on the magnet pole piece shields. The design and operation of the bending magnet are described. The missing neutral power caused by charge exchange losses is discussed. The experimental data are compared with that calculated using two Monte Carlo computer codes, TRAN3D and REION, and it is concluded with an examination of an accident which resulted in the melting of copper louvers bordering the magnet gap.

34848 **(GA-A—17379) Operating experience with 80-keV/80-A ion sources in use for Doublet III NBI experiments.** Kim, J.; Colleraine, A.P.; Fasolo, J.A.; Hong, R.; Kamperschroer, J.H.; McColl, D.B.; Palmer, H.L.; Silagi, R.L.; Tooker, J.F. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 7p. (CONF-831203—158). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012962.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The present phase of the Doublet III neutral beam injection experimental program uses three beamlines, each beamline employing twin 80 kV/80 A, 10 cm x 40 cm, LBL-type, hydrogen ion sources. This is the first neutral beam heating experiment to use industrially fabricated sources with a two-stage accelerator system and to operate at such high energy per nucleon. In this paper, we present actual online performance of these ion sources, compare the performance of these ion sources, compare the performance data with the design values, and discuss hardware aspects of ion source fabrication and maintenance.

34849 **(GA-A—17380) Feedback-controlled gas feed system for ion sources.** Tooker, J.F.; Kamperschroer, J.; Burrell, K. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—161). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012963.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The gas feed system, which supplies the gas to the ion sources, used on the Doublet III neutral beam injectors was workable, as originally configured, but has a number of inconveniences and difficulties. A new gas system is being developed which is an adaptation of a system used in a variety of applications in tokamak experiments. For each ion source, the system is comprised of four valve assemblies and valve controllers, three for the ion source and one for the neutralizer. Each valve assembly consists of a length of submillimeter tubing a pressure transducer, and a piezoelectric valve. A flow of 0 to 40 Torr-liter/s of hydrogen is achieved through a 400 cm length of 0.53 mm radius tubing. This tubing is plastic to provide the high voltage isolation between the high voltage of the ion source and the valve assemblies which are located at ground potential. The system is interfaced via one of the neutral beam computers and CAMAC to a console in the control room from where the flow is programmed. System description and adaptations will be presented. Performance of the system as operated and adjusted on the bench will be presented.

34850 (INIS-mf—8903, pp 57-59) **Calculation of the effect of suprathermal electrons in laser-irradiated targets using a simple model.** Krumbein, A.D. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1982. NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780391. (CONF-821276—).

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

34851 **(INIS-mf—8903) Joint annual meeting 1982. Transactions, Volume 10.** (Israel Nuclear Society, Yavne; Israel Health Physics Society; Radiation Research Society of Israel; Israel Society of Nuclear Medicine). 1982. 240p. (CONF-821276—). NTIS, PC A11/MF A01. Order Number DE84780391.

From Nuclear Societies of Israel joint annual meeting; Tel Aviv, Israel (14 Dec 1982).

Separate abstracts were prepared for each of the included papers. (MOW)

34852 (INIS-SU—202, pp 38-47) **Tokamak-7 operation in experiments with a plasma.** Buzanki, V.V.; Bychkov, A.V.; Denisov, V.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of experiments with plasma at the Tokamak-7 (T-7) device are presented. The experiments have been carried out with a constant diaphragm of 31,5 cm radius and two movable graphite diaphragms at the 26-28 cm plasma filament radius and 1,6-1,9 T magnetic field. Two stable regimes with 150 and 200 kA and 250 ms discharge current length have been investigated. It is shown that the strongest poloidal filed perturhations have been observed at the beginning of the discharge. Electron plasma temperature Tsub(e) has been determined from the spectrum analysis of soft X radiation by the foil method. Stable plasma regimes with current up to 200 kA, bypass voltage being equal 1,58V electron density -0,5-5,0 x 10^{13} cm^{-3}, Tsub(e)=1,1-1,3 keV ion temperature-490 eV. The range between discharge pulses has reached 3 min. at the discharge current-240 kA. No considerable effect of magnetic field variables on the superconducting magnetic system has been observed.

34853 (INIS-SU—202, pp 48-58) **Experimental investigations of the "Angara-5" facility module.** Beruchev, N.G.; Bol'shakov, E.P.; Buytsev, V.A. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The description and results of experimental investigation of the head module of the "Angara-5" facility are presented. The module represents and energy storage consisting of the Arkadiev-Marx generator and double shaping line (DSL). The intermediate DSL electrode is conneeted with the generator by two conductors passing through the separating section with four dielectric partitions. In the course of DSL commutation realized by five gass-filled commutators internal electrode charging is performed through the cantilever being isolation induction. Basic DSL characteristics are given. In the process of operation on increasing charge module voltage about 180 pulses with DSL charge voltage-1 MV, 80 pulses with charge voltage 1,6 MV and 10 pulses with 2,1 MV voltage have been performed. In all module operation conditions no breakdown in water have been observed. Time spread of commutators switch on not exceeding +- 2,6 ns. Gas discharge channel losses are given. The module power balance under capacitor charging voltage +- 80 kV is presented.

34854 (INIS-SU—202, pp 67-88) **JET, the Joint European torus - a status report.** Rebut, P.H.; Green, B.J. (JET Joint Undertaking, Abingdon, Oxon, UK). 1982. NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Present status of the construction of the Joint European Torus (JET) is described. Cutaway view of JET showing the main compononts is given. Main JET parameters are presented. Of the 32 toroidal field coils required, 27 have been manufactured and delivered (April 1981) to the JET site. The production of poloid l field coils is proceeding very satisfactorily. Progress with the manufactur of the magnetic circuit has been very satisfactory. The design of the neutral beam injection system is well advanced. Work began on the site in May 1979. The control building is complete and most of the computers and consoles of the JET Control and Data Acquisition system are already installed. The power supplies building and the generator building are complete and the installation of equipment is proceeding rapidly. The experimental or operational phase should begin in mid-1983.

34855 (INIS-SU—202, pp 89-96) **Design and first results of the ASDEX TOKAMAK.** Rapp, H.; Wesner, F. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); European Organization for Nuclear Research, Geneva (Switzerland)). 1982. NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The design principles of the ASDEX divertor tokamak and its main rasults of technical interests are presented. It has been successfully operated since February 1980 as a divertor tokamak. In this mode experiments have been carried out with plasma currents of up to 450 kA and pulse length of up to 11 s. The most striking results are: the use of a magnetic limitor instead of a mechanical limiter reduces effects caused by plasma-wall interaction; the use of feedbacks for the vertical and radial plasma positions for the plasma current and for the electron density allow very stable and reproducible discharges without plasma disruptions for pulse lengths of up to 11 s; for the ignition of the discharge an open loop voltage of only 10 V is needed. The plasma parameters reached so far with ohmic heating are: plasma current-450 kA, pulse length-3 s (with superthermal electrons-11 s), ion temperature - 0,8 keV, electron temperature - 1,2 keV, average density - 6,5x10^{13} cm^{-3}, energy confinement time <= 70 ms.

34856 (INIS-SU—202, pp 97-104) **Some aspects of research and development for thermonuclear fusion facilities in Toshiba.** Yamimoto, K.; Itoh, S.; Nagamura, J. (Toshiba Corp., Fuchu (Japan). Fuchu Works). 1982. NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Some results of research and development for thermonuclear fusion facilities such as magnetic field systems, vacuum systems and neutral beam injection systems fabricated in Toshiba (Japan) are presented. In order to evaluate analytical results on magnetic field the testing device has been manufactured. A superconductor is developed whose critical current is 3000 A at 10 T. Large D-shaped superconducting test coil was constructed. The diagram of a test device for a titanium getter pump is given. Neutral beam injection systems have been developed. The constructed fusion research facilities are enumerated.

34857 (INIS-SU—202, pp 105-112) **Robototechnical complex for the "INTOR" installation remote control.** Popov, E.P.; Kuleshov, V.S.; Ushakov, V.I. (Moskovskoe Vysshee Tekhnicheskoe Uchilishche (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The robototechnical complex for the thermonuclear power installation "INTOR" remote control is developed. By means of maniputators possible is substitution of ampules with vertical lead-in into the chamber, remote control of the side part of installation protection sheath substitution of experimental modules units and first wall protection units as well as blanket divertor units, revision and repair of the first wall. Maniputation remote operation control is realized from a united control center. The control center ensures general control organization and comprises central control station and control stations of separate robots. In case of failure of one of the manipulators remote control can be realized by another robot. Automatic and remote regimes of the robot actions control are the main ones. However in the system envisaged is as well the possibility of combined control with direct operator participation in the process of manipulator motion control.

34858 (INIS-SU—202, pp 113-120) **Main technological and physical problems of the new torsatron- "Uragan-3".** Ameliya, V.Z.; Bronnikov, V.V.; Burchenko, P.Ya. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Basic technological and physical problems of the "Uragan-3" torsatron (U-3) are enumerated. U-3 represents a torsatron without special winding of a toroidal magnetic field. Equiinclined helical winding combined with a compensating winding consisting of two current rings ensures creation of a regulated magnetic configuration with a divertor at the high level of magnetic field induction required for stable plasma confinement. Magnetic surface parameters are given. The divertor specific features are described and U-3 subsequent modernization possibilities are shown: magnetic field increase up to 5 T, using superconducting pumping out facilities of efficiency up to $2x10^6$ l/sec and neutrat particle injectors installation for plasma additional heating. U-3 is to realize two functions: plasma production in the non-current regime of ohmic heating and plasma heating up to high temperature. The HF heating methods which are to be realized in U-3 are enumerated.

34859 (INIS-SU—202, pp 136-142) **Main concepts for a stationary reactor-torsatron.** Bykov, V.E.; Volkov, E.D.; Georgievskij, A.V.; Rudakov, V.A.; Suppunenko, V.A.; Tolok, V.T. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of investigations on studying the possibility of designing a stationary reactor with 2-4 GW electric power on the l=3 torsatron basis are presented. Calculations have shown that reactor plasma parameters may correspond to the "plateau" regime as well as "superbanana" regime of the neoclassical transport theory. The influence of plasma contamination by α particles on reactor parameters is studied. Stable burn up regimes have been found. It is shown that burn up stability is ensured by transport coefficients certain regularities characteristic of stellarator systems. The reactor characteristics dependences on collision parameter and wall loading in the "plateau" regime are given. Reactor parameters at various regimes are given as well. The reactor typical parameters are as follows: average plasma boundary radius-2 m, aspect radio-20-25, magnetic induction 5,5-7,5 T, ion component temperature 6,5-8 keV, criticaly factor β=5-10 %, electric power 2-4 GW.

34860 (INIS-SU—202, pp 156-163) **Reactor considerations for the "compart torus" thermonuclear facility with an autonomous ignition chamber.** Kurtmullaev, R.Kh.; Malyutin, A.I.; Semenov, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The specific features of a compact torus discovering new prospects within the solution framework of thermonuclear reactor technological problems are shown. Estimation parameters of the "Compact torus" system with an inductive storage of 100 M7, 270 cm diameter and 3m length are given. The discharge chamber, diameter equals 40 cm. For production in plasma a captured reverse magnetic flux it xs suggested to use the proper magnetic field of the "charged" storage by means of placement in its cavity of a shock chamber. The torus injection from dielectric shock chamber is a powerful method of its radiation protection while continuous plasmoid trial run accross the long ignition chamber reduces neutron and thermal first wall loading. Compact torus are ejected into the ignition chamber where they release energy with the amplification coefficient Q, which depending on generator characteristics of a pulse magnetic field is to constitute .10-50.

34861 (INIS-SU—202, pp 164-172) **"Magnetic trap" type thermonuclear device with minimum B for a plasma with β approximately 1.** Konkashbaev, I.K.; Popova, V.A.; Skvortsov, Yu.V.; Tserevitinov, S.S.; Shneerson, G.A.; Shutov, V.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The description of the "magnetic trap" type thermonuclaar device with minimum B for plasma with β approximately 1 is given. The thermonuclear device comprises two pulse injectors with plasmaguides and a working chamber which represents a thin wall liner in the volume of which by means of a multiturn solenoid an initial magnetic flux is specified. At passive liner faces coils creating acute-angle geometry of the confined magnetic field are mounted. The liner heating factors are est tic field are mounted. The liner heating factors are estimated in the course of reaction which allows to determine the liner wall thickness equal 1-2 cm and internal diameter for the 30 T induction field not exceeding 4-6 cm. Total system length constitutes 5,5 m. The system is to produce approximately $6x10^{17}$ neutrons for a pulse and at 1 Hz operation frequency can run in the blanket up to $1.2x10^{18}$ plutonium atoms per second. Thermal energy of 50-100 MJ are to release which at the thermal cycle efficiency equal 0,4 permit to obtain 20-40 MW of electric energy.

34862 (INIS-SU—202, pp 181-188) **Technological problems for construction of a "Combined pinch" device.** Butov, I.Ya.; Bubnov, S.V.; Gvaladze, Yu.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of the "combined pinch" (CP) device development with the stored up in the capacitors battery 2 MJ energy intended for investigating pulse high-current plasma with high β at joined zet and theta-pinch discharge are presented. Main CP systems are briefly described and their technical characteristics are

given. As a result of designing CP an energy storage is constructed which permits to produce in a working chamber an axial discharge current with maximum amplitude 2 x 10^6 A and growth rate 5 x 10^{12} A/c, axial magnetic field with amplitude 10 Tl and growth rate 5 x 10^6 T/s and quasistationary magnetic field 1 T. A preliminary working gas ionization and its preheating up to 1-10 eV temperature is realized. The storage control system and the device technical parameters control system are developed. The expected plasma parameters variation range is as follows: electron density 5 x 10^{14}-10^{16} cm^{-3}, electron and ion temperature 1-10 eV - in the preheating phase and electron density 2 x 10^{16}-3 x 10^{17} cm^{-3}, electron temperature 0,5 keV, ion temperature 0,5-3 keV in the maximum pinch compression phase.

34863 (INIS-SU—202, pp 196-201) **Estimation of reliability of a nuclear power plant with tokamak reactor.** Klemin, A.I.; Smetannikov, V.P.; Shiverskij, E.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The results of the analysis of INTOR plant reliability are presented. The first stage of the analysis consists in the calculation of the INTOR plant structural reliability factors (15 ibs main systems have been considered). For each system the failure flow parameter (W(1/h)) and operational readiness Ksub(r) have been determined which for the plant as a whole besides these factors-technological utilization coefficient Ksub(TU) and mean-cycles-between failures Tsub(o). The second stage of the reliability analysis consists in investigating methods of improving its reliability factors reratively to the one calculated at the first level stage. It is shown that the reliability of the whole plant to the most essential extent is determined by the power supply system reliability. The following as to the influence extent on the INTOR plant reliability is the cryogenic system. Calculations of the INTOR plant reliability factors have given the following values: W=4,5 x 10^{-3} 1/h. Tsub(o)=152 h, Ksub(r)=0,71, Ksub(TU)=o,4 g.

34864 (INIS-SU—202, pp 202-207) **Technological tokamak reactors with a high density plasma.** Vojtenko, D.A.; Demirkhanov, R.A.; Kirov, A.G.; Stotland, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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With the purpose of determining the efficiency criterion of the engineering-technological tokamak-reactor (ETTR) with high plasma density the equation system of the stationary zero-dimension tokamak plasma model jointly with the ETTR system of physical and technological restrictions and cost estimates has been solved. As efficiency criterion the concept of specific cost of fluence storage rate called "fluence cost" Ssub(f)=S/p, where S is ETTR cost, p-specific neutron first wall. The leading ETTR versions with p=100,400 and 1000 $Wxcm^{-2}$ have been considered which distinguish by two different toroidal field winding versions-cryoresistive based on superpure aluminium and superconductive based on Nb_3Sn. It follows from the analysis results that at high p values optimal ETTR with minimum "fluence cost" are realized. From the ETTR comparison with superconductor and cryoresistive toroidal field windings one can see that the Ssub(f) main dependences course on reactor parameters is analogous, however Ssub(f) and S values in the case of cryoresistive toroidal field windings is 5 time lower.

34865 (INIS-SU—202, pp 215-223) **First results of the MT-1 tokamak start-Up, TsIFI Hungary.** Byurger, G.; Kardon, B.; Kostka, P. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of the MT-1 tokamak start up with the parameters: large radius 0,4 m, round limiter radius from Msub(o) 0,09 m, copper case radius-12 cm are presented. Toroidal coil consists of 20 turns. Maximum magnetic induction 2 T. At the present stage metering schemes of usual electric diagnostics are mounted at the MT-1. The Tomson scattering measuring system neutral particles spectrometer, active corpuscular diagnostics and microwave interferometer as well as data acquisi- tion and processing system on the computer base are prepared. The first results of MT-1 performances are presented. The stable discharge is obtained within the plasma current limits 7-35 kA, 2-4 V voltage, H_2 gas pressure in the chamber (0,8-6)10^{-4} tor. The maximum energy confinement time-0,9 m/s is obtained. Soft and hard x radiation spectra are given. Distributions of plasma atom-contaminators in the dark region behind the liner are presented.

34866 (INIS-SU—202, pp 224-231) **VT-6-2 screw torus type thermonuclear device.** Vizgalov, I.V.; Dobryakov, A.V.; Igritskij, A.N. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

With the purpose of designing a stationary thermonuclear reactor engineering-physical and structural design development of the VT-6-2 six-period screw type torus calculated for ion-hot stable plasma production with the 2,5 T field is realized. The VT-6-2 axis length equals 15,07 m. The radius of curvature and twisting of the magnetic exis equals 0,55 m. The rotational transformation angle equals 4,63 rad. The plasma average radius is 0,13 m. The plasma expected parameters are: ion temperature 3-5 keV, plasma density 10sup(19-20)msup(-3), β=0,3. The longitudinal field solenoid is chosen in the form of 120 identic coils arranged along the spiral in such a manner that the spiral tangent coincides with a normal to the central coil region. The electromagnetic system parameters are given. Possibility of the VT-6-2 device practical realization is shown.

34867 (INIS-SU—202, pp 232-239) **Parametric analysis of a power plant with an electron beam hybrid fusion reactor.** Kalmykov, Yu.K.; Komin, A.V.; Krivosheev, M.V. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of themonuclear power plant parametric analysis with an electron beam microexplosion initiation are presented. The estimations have been performed with high energy release in a target with a liquid first wall-blanket (LFWB) and nuclear fuel conversion in the outer blanket. The hybrid plant model comprises the following elements: reactor chamber LFWB, outer blanket target unit reaction ignition system, energy conversion system. In the course of ignition system modeling it has been assumed that its costs capacitance storage costs. The energy transferred to the target has been accepted to be equal 5 MJ, storage energy with regard to efficiency of energy transfer into the beam and transport losses-2a MJ. The chamber form has been accepted as a cylindrical one. As LFWB material eutectics has been considered. It is shown that the maximum permissible cost of the failure reactor part under pulse energy release of 10 ^{11} J order showed constitute 3 dollars for a purely thermonuclear and 10 dollars for hybrid version of the plant.

34868 (INIS-SU—202, pp 240-246) **Parametric study on a reactor with a liner using a simplifed economical model.** Krivosheev, M.V.; Mineev, A.B. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Sorin, V.M. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of optimization calculations of thermonuclear power plant (TNPP) based on the reactor with a cumulating nonevaporated liner made of the Pb_4Li eutectics melt with the following

characteristics: density $9x10^3$ kg/m^3, evaporation heat 1,1 MJ/kg, heat capacity 0,2 kJ/kg degr. Injector efficiency has been accepted to be equal 0,5 TNPP operation time a year 7000 h. Dependences of the relation of given specific expenditures to the substituted power plant expenditures on liner compression degree, β relation in the compression maximum, Ksub(ei)-of initial value of external-internal liner radii relation and g parameter determining the relation of energy returned to the storage at a reverse liner scattering to initial storage energy. From the optimal TNPP view point the system parameters are as follows: plasma pressure $3x10^8$ Pa, injected plasma temperature 1 keV, plasma temperature in the compression maximum 10 keV, g=1,4, β approximately equal 2, Ksub(ei) approximately equal 2, external initial liner radius and its length 4,4 m and 3,4 m, respectively, pulse energy 8 GJ, cycle duration 7 s, TNPP electric power netto 0,7 W. Apart of direct energy conversion in total supplied energy to the consumer is 20 %. It follows from the results analysis that the given specific TNPP expenditures even for a pure reactor do not strongly differ from expenditures on electric energy produced for substituted plants.

34869 (INIS-SU—202, pp 274-281) **Preliminary parametric investigations of a thermon clear power plant with a torsatron reactor.** Artyugina, I.M.; Kantan, V.V.; Semenov, A.A. (Leningradskij Politekhnicheskij Inst. (USSR)); Mineev, A.B.; Komin, A.V.; Krivosheev, M.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Georgievskij, A.V.; Rudakov, V.A.; Suprunenko, V.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of parametric analysis of thermonuclear electric plant (TNPP) based on a pure thermonuclear torsatron reactor are presented. As an optimization criterion the minimum of specific investments netto has been accepted. The performed investigations allow one to recommend as optimum for the thermonuclear torsatron reactor the value of aspect ratio 17-19 number of screw winding periods 6-7 and first wall loading 4,5-5 MW/m^2.

34870 (INIS-SU—202, pp 282-288) **Forecasting parameters of a the monuclear power plant with a torsatron reactor.** Artyugina, I.M.; Semenov, A.A.; Smirnov, A.N. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A number of problems related to forecasting technical economical factors of thermonuclear electric plant (TNPP) based on the torsatron reactor is considered. Possible methodic approaches to the estimation of TNPP nonstandard equipment construction-mounting works and the results of forecasting the investment structure in TNPP are analysed. The influence of TP basic systems on the total investment value depending on accepted price level is shown. Quantitative estimations of specific investments and electric energy production cost permit to estimate rather optimistically the considered TNPP type and to draw a conclusion on advisability of the further study.

34871 (INIS-SU—202, pp 289-296) **Design of the T-13 tokamak.** Bortnikov, A.V.; Brevnov, N.N.; Efimov-Ilovajskij, A.V.; Zhokin, A.M.; Sokolov, N.I.; Shurov, O.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The description of the T-13 tokamak device intended for experimental investigation of the dependence of plasma energy lifetime on various parameters of plasma filament for studying additional heating methods at the expense of adiabatic compression of non-circular cross section filament and during fusion of several filaments. By the device it is possible to obtain the plasma filament with the following parameters small radius 0,09 m, plasma concentration 5 x 10^7 m^{-3}, electron temperature 100-400 eV, energy confinement time 2 ms. The T-13 electromagnetic system consists of 20 coils (wafers) of toroidal magnetic field having magnetic induction value 1,4 T at the 0,4 m radius. The vacuum chamber represents a rectangular cross section torus with internal dimensions a,2 x 0,68 m. The chamber consists of four sections and is made of stainless nonmagnetic steel. Inside the chamber a conducting copper sheath is installed. The vacuum pumping out system ensures the rarefaction degree 1 x 10^{-9} mm. Hg.

34872 (INIS-SU—202, pp 297-304) **Parametric analysis of a power plant on the basis of laser fusion.** Kalmykov, Yu.K.; Komin, A.V.; Krivosheev, M.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Rozanov, V.B. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of parametric analysis of power plant on the basis of laser fusion are presented. The model taking into account only the basic systems: laser, laser supply source, chamber, blanket, heat power system has been used. The calculation results are presented in the form of dependences of expend,ture for electric energy production by the complex hybrid plant-nuclear fuel reprocessing plant-NPP on laser energy. It is shown that the hybrid plant fissile material breeder can be competitive in relation to nowdays NPP at a certain 01,5-3 times nuclear fuel price increase. For this purpose one must obtain high energy amplification coefficients in the thermonuclear target (>=100) rather high frequency of laser pulse recurrence (>1Hz), to ensure large radius of laser and fuel elements operation (>10^8 pulses) and a relatively low cost of the laser system (<= 100 doll./7).

34873 (INIS-SU—202, pp 305-312) **Some parameters of a stellarator reactor with helical magnetic axis.** Georgievskij, A.V.; Nemov, V.V.; Sergeev, Yu.F.; Shishkin, A.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Some parameters of a stellarator reactor on the basis of magnetic system consisting of helical coils and solenoid with plane-geometry and helical magnetic axis are analysed. The parameters and main geometric relations of the stellarator reactor are: aspect ratio 15, plasma radius 1m, toroidal field 5 T. Due to allocation of blanket and protection with varied thickness, the efficiency in using the volume limited by the magnetic system has increased. The given stellarator reactor type has some advantages over the reactor with a traditional stellarator magnetic system, such as somewhat increased β value (β <= 10 %) and possibility of substantial current value decrease in the helical coil. Besides the system with a space axis in contrast to hel+cal torus does not require helical toroidal vacuum chamber which can result in a more simple structure of similar systems.

34874 (INIS-SU—202, pp 313-323) **Design and construction of a megajoule plasma-focus experiment.** Jerzykiewicz, A.; Bielik, M.; Budkowski, W. (Institute of Nuclear Research, Warsaw (Poland)). 1982. NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The present status of the design and construction of two plasma-focus devices PF-1000 of an energy 1,15 MJ and PF-300 of an energy 360 kJ are described. The principal properties of these devices are shown. The chamber of PF devices will be pumped out to a pressure of 10^{-5} Tr. To select appropriate electrodes matched to the power supply system a number of computations have been performed. From calculations it results that the maximal value of the pinch current will be obtained for 10 cm diameter inner electrode. The scheme of PF electrodes connection is given. The PF-300 device will be used for testing the subunits constructed for PF-

1000 and for preliminary verification of the concepts of physical experiments and theoretical considerations. The PF-1000 will be installed in a three-floor high hall of dimension 18 x 18 m. Chamber dimensions are: diameter 150 cm; length 200 cm. Diameter of external electrode 90 cm cable collector diameter 250 cm.

34875 (INIS-SU—202, pp 324-330) **Neutron plasma sources on the base of electromagnetic traps for technological testing of thermonuclear reactor materials.** Karpukhin, V.I.; Lavrent'ev, O.A.; Petrenko, V.I.; Sappa, N.N. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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With the purpose of constructing neutron plasma sources which are able to imitate radiation conditions in a thermonuclear reactor electromagnetic traps (EMT) are considered. In the traps plasma is produced by working gas ionization with an electron beam directly in the trap volume while high power ions may be indroduced thorugh magnetic slits. Two EMT regimes are considered. In the first regime deuterium and tritium are introduced into the trap in the form of neutral gas while plasma production and its heating are realized by means of electron injection of electron cyclotron resonance. In the second regime into the EMT plasma produced by gaseous deuterium ionization through the magnetic slits introduced is tritium ion beam with energy ensuring their capture in a potential well of negative volumetric electron charge. In this case the EMT plasma represents a target in which tritium ion beam is slow down initiating thermonuclear reactions accompanied by 14 MeV neutron emission. It concluded that injecting into the EMT plasma ion beams with currents approximately 100 A (which nowadays is technically feasible) one can produce a neutron source with approximately 10^{19} n/s, intensity creating close to the first wall neutron fluxes approximately 10^{14} n/cm^{2}xsec i.e. quite suitable for radiation testing materials of future thermonuclear reactors.

34876 (INIS-SU—202, pp 331-336) **System of electron-cyclotron heating of a plasma in the T-15 tokamak.** Alikaev, V.V.; Arsen'ev, Yu.I.; Doohenkov, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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Technical solutions in development of complex of SHF plasma heating in the T-15 tokamak are reported. Plasma heating is supposed to be realized by electromagnetic waves at electron-cyclotron frequency. The T-15 generator complex consists of 24 operating independently of each other generators with output power 0,2-0,3 MW each. SHF energy is transfered to the plant from each generator by a separate wakeguide. The HFE energy is realized by means of two input facilitigs joined to branch pipes of the toakmak discharge chamber. As SHF radiation source power gyrotrons are used. The SHF energy input into the T-15 chamber is supposed to be realized by the mirror system. The SHF power supply system of generator complex consists of a 80 kV modulator and low-voltage sources for gyrotron filament supply of superconducting and correcting solenoids of the built in electric discharge pump.

34877 (INIS-SU—202, pp 337-343) **Design of a technical complex for ecr heating of a plasma in the L-2 stellarator.** Borisov, A.V.; Kolik, L.V.; Krasnikov, E.Yu.; Petrov, A.E.; Sapozhnikov, A.V.; Sarksyan, K.A. (AN SSSR, Moscow. Fizicheskij Inst.); Usov, V.G.; Frajman, A.A. (AN SSSR, Gor'kij. Inst. Prikladnoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The design of a technical complex for experiments on electron-cyclotron heating (ECH) of hydrogen plasma in the L-2 stellarator is presented. For ECH at the first and second harmonics of gyrofrequency two types of gyrotrons with wavelength 10 and 3,6 mm and radiation power 100 and 300 kW at pulse duration 1 and 20 ms respectively are used. For consistent radiation input into plasma a quasioptical channel is employed. As a result during ECH at the first gyrofrequency harmonic an unusual wave with lambda=10 mm through the four mirrors system is introduced into the L-2 upper branch pipe of 60 mm diameter in the form of gaussian wave beam of 55 mm diameter. For the second gyrofrequency harmonic through the three mirrors system SHF-beam with lambda=3,6 mm gets into the branch pipe of 86 mm diameter with dimensions 46x62 mm. In the ECR region its dimensions constitute 40x60 mm. As a switch-lamp high-voltage triode GMI 43 A is employed in the circuit control regime. As a storage a single artificial shaping nonconsistent line with oil filling is used.

34878 (INIS-SU—202, pp 344-351) **Charged particle energy recuperation in thermonuclear device in reactors.** Vizgalov, I.V.; Vinogradova, O.A.; Dimitrov, S.K.; Luts'ko, A.S.; Makhin, A.V.; Smirnov, V.M.; Tel'kovskij, V.G. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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Recuperation systems for hybrid thermonuclear reactor injector of open type (TROL) are considered. The ion source D^- with 50 A current and 50 keV energy shapes a sheet beam. In the separating magnet the beam separates from the electron flow is focused and accelerated in electrostatic accelerator field up to 1,4 MeV energy. Further on the beam recharges in D^0 atoms in hydrogen plasma target. A part of the flow remains in the form of D^- and D^+ ions and is directed into the recuperator with crossed electric and magnetic fields. Subsequently fast neutral atom flux with 56 MW power is directed to the TROL main end trap but a part of the flux (16 MW) passes by the trap without interacting with plasma. After the trap almost all neutral atoms (98%) are transformed into D^+ ions in a steam-jet met lithium target. Subsequently 13 MW of D^+ ion kinetic energy are converted into electric energy in the end electrostatic recuperator. The recuperator with crossed fields consists of two symmetric parts each of which comprises the system of electrodes creating a decelerating field and ion collector. Overall recuperator dimension is 2 m. In the electrostatic recuperator electrodes are assembled in a packet on four ceramic rods. The collector is manufactured in the form of water cooled homogeneous flit shields. The recuperator basic parameters are; general ion current at the recuperator inlet 11 A "volumetric charge parameter" 0,16 recuperator general length-300 cm, recuperator efficiency 0,9. The D^+ energy conversion is realized by means of a scheme in which the collector current converted into alternative supplies primary high-voltage winding of the reducing transformer.

34879 (INIS-SU—202, pp 352,356) **JREK experimental injector.** Semashko, N.N.; Bezverbaya, N.K.; Beluzhkin, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The development of construction of full-scale experimental stand of T-15 tokamak injectors-IREK injector and its main supply systems is accomplished. IREK is calculated for the operation of one module of ion source with emission area 420x160 mm which can yield an ion beam with 100 A current at the energy up to 160 keV and injection pulse duration up to 20 s. IREK consists of two rectangular vacuum-injector chambers and a diagnostic chamber. An ion source with beam neutralizer is mounted at the injector chamber. In the vacuum chamber current-collectors, diaphragms, deflecting electromagnet, magnetic flit shield gas pumping out means are located. In the diagnostic chamber the diagnostic atom receptor and gas pumping out means are placed. The diagnostic volume and injector chamber are linked with atomguide. Internal chamber dimensions: height 3,5 m, length 3,5 m, width 2m IREK ensures transport of atom beam of power up to 3 MW to the distance of 9 m. A greater part of the IREK systems is in the manufacturing and mounting stage.

34880 (INIS-SU—202, pp 357-363) **Design of ion-atom channel of the T-15 tokamak injector.** Chukhin, I.A.; Nikulin, V.A.; Seregin, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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Calculation parameters of ion-atom channel elements are given and the design of T-15 tokamak injectors meant for input of atom beam of 10 MW power at 80 keV energy and pulse duration 1,5 sec. into the tokamak chamber for plasma heating as described. Injection system is based on simultaneous operation of three autonomous injectors. In each injector two modules of ion sources are mounted. The ion-atom channel of the injector consists of two ion sources neutralizer of ions beam into fast atoms beam magnetic flit shield, diaphragms ion and atom receptors deflecting electromagnet, cryopanels of 15 cm^2 general area, rectangular vacuum chamber manufactured of sheet steel 12Kh18N10T of 16 mm thickness. The vacuum chamber weight constitutes 25 tons volume 24,5 m^3. Ion sources are situated one above another by vertical order. In neutralizers ion beams formed are converted into fast atom beams on gas base. Behind the neutralizer situated is magnetic flit shield along the length of which gas pumping out occurs. Separation of atoms and non recharged ions is realized by the deflecting electromagnet. The deflected ions get to the receptor and fast atoms by atomguide into the tokamak. The injector diaphragm protects the electromagnet construction from overheating.

34881 (INIS-SU—202, pp 364-371) **IBM-5C stationary in source without an external magnetic field.** Kulygin, V.M.; Malakhov, N.P.; Panasenkov, A.A.; Pleshivtsev, N.V.; Romanov, V.I.; Semashko, N.N.; Seregin, V.S.; Chukhin, I.A.; Shmeleva, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

With the purpose of constructing efficient injectors of hydrogen fast atoms for plasma heating in magnetic traps problems arising in the course of creation of stationary high-current ion sources and specific methods of solution of these problems are considered. The design and characteristics of the YVM-50 stationary ion source without an external magnetic field intended for obtaining hydrogen ion beams with energy up to 40 keV, current 30 A and pulse duration over 2 sec. are described. Thermal regime of ion source direct heating cathode is considered. It is shown that the lanthanum hexaboride cathode at the temperature 1700 deg C ensures 30 A/cm^2 emission density radiating about 60 W/cm^2. YBM-5c consists of a gas-discharge chamber (GDC) and ion-optical system (IOS). GDS is composed of a cathode unit, anode flange, casing, gas supply system, IOS consists of emission accelerating and earthed electrodes. At the discharge pulse duration less than 1 sec. current emission density attains 0,5 A/cm^2 which permits to extract from the ion source 30 A current beam. The ion source operation in complex with a high-voltage supply system has shown that one of the most important problems is reliability of high-voltage protection from break-downs and stability of modulators operation.

34882 (INIS-SU—202, pp 380-386) **System of energy transfer for HF heating of the T-10 tokamak plasma.** Longinov, A.V.; Kovalenko, V.I.; Miroshnichenko, G.A.; Nizhnik, G.Ya. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The results of development and investigation of the system of HF energy transfer for plasma heating at the T-10 tokamak are presented. Structural features of the transfer system comprising radiating surface, transfer band line and electrostatic shield are described. Basic chapacteristics of the transfer system are given: power interoduced into plasma 5 MW, pulse duration <0,3 s, efficiency 0.8-0.93 operating frequency 30-60 MHz. The results of the system testing have shown that due to small input impedince of the radiating surface it ensures transfer into plasma of high energy levels at a relativey low HF-potential value on its elements situated near the plasma filament, the transfer system has a large area of the radiating surface and its structure permits to perform Mounting operations in the chamber. The conclusion is drawn that the developed type of the transfer system can be applied in designing HF plasma heating systems in large scale tokamaks.

34883 (INIS-SU—202, pp 387-389) **Some technological problems for pulse thermonuclear systems with an exploding linear.** Azizav, Eh.A.; Bazilevskij, V.P.; Bogdanets, A.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The results of calculation of and magnetic field plasma compression and confinement by a multilayer linear at specified linear velocity 1 km/s and plasma compression velocity 5-10 km/s and linear kinetic energy of striker 2+5 MJ/cm are presented. For obtaining plasma for filling the liner it is proposed to use a pulse electrodynamic accelerator. For throwing strikers toroidal coil of 9m diameter, height 2.2m, maximum current $4x10^6$A, Voltage $5x10^4$V, magnetic pressure 726 bar is used. The coil is switched to the inductive storage of 167 power, optimum dimensions and characteristics of the thermonuclear system constituting: system length 220 cm, initial plasma radius 4 cm, plasma concentration $3.4x10^{18}cm^{-3}$, plasma temperature 0.6 keV compression velocity 2.3 km/s. Initial magnetic field at the linea+ radius 6 cm equals 0,06 MPs. At the moment of maximum compression the plasma radius constitutes 0.36 cm concentration $4.13x10^{20}cm^{-3}$ temperature 8.32 keV, pressure 11 mbar. Total energy released in the liner and striker constitutes 8.6 GJ.

34884 (INIS-SU—202, pp 399-401) **Ion source cathodes of melted and sintered lanthanum hexaboride.** Malakhov, N.P.; Semashko, N.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); MorozoV, V.V.; Shlyuko, V.Ya.; Kresanov, V.S.; Goncharuk, A.I. (Kievskij Politekhnicheskij Inst. (Ukrainian SSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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With the purpose of choice of optimum conditions of ion source cathode operation investigations on manufacturing cathodes lanthanum hexaboride by the sintering or melting method. It is shown that the sintered material structUre consists of a large quantity of grains which permits to heat the cathode using maximum possible velocities (1000-1300 degr./min.). In the melted material the structure is coarse-grained, such structure requires less heating Velocities (not more than 300 degr./min). The melted cathodes advantage over the sintered ones is shown. It is shown as well that application of titanium diboride on current-carrying elements permits to increase reliability and stability of the cathode unit operation.

34885 (INIS-SU—202, pp 402-409) **Monolithic fiberglass metalloceramic insulating unit.** MalakhoV, N.P.; NoVikoVa, G.P.; Semashko, N.N.; GUrevich, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Goremykin, V.A.; Murashko, L.N. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The design and technology of manufacturing monolithic fiberglass metalloceramic insulating units of ion sources of the ion magnetless module type are developed. Structurally the insulating unit represents a three-flange system divided by insulating seals. Thermal properties of insulating units are studied. Determined are

the maximum permissible thermal flows when insulators serviceability is not changed. Temperature distribution orer the external side of the ceramic insert its profection properties are determined as well. Structural materials for manufacturing carrying part of insulating elements, ceramic insert material and compound compositions are chosen. Their electric characteristics are measured. Serviceability control of insulators in ion sources has shown that they successfully operate in pulse (20- 50 ms) high current ion sources in which ion energy equals 25 keV while ion current constitutes 30 A.

34886 (INIS-SU—202, pp 424-431) **Choice of optimal parameters for a fast atom injector.** Vetrov, V.A.; Latyshev, L.A.; Rybaulin, N.M.; Semashko, N.N.; Seregin, V.S.; Chuyan, R.K. (Moskovskij Aviatsionnyj Inst. (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The present investigation deals with optimization of imitation model of hydrogen (deuterium) fast atoms injector ensuring energy input into the thermonuclear reactor plasma. The injection scheme with recharge of fast positive ions is considered. As optimicability criterion the function determining energy costs for power unit introduced into the reactor is used. The injection system comprises a number of elements: ion source with a gas discharge chamber neutralizer separator ion receptor atom caloriqeter-receptor atomguide and cryogenic vacuum chamber. The analysis of structural scheme of the injector imitation model has shown that output parameters of one group of modules are input parameters for calculation of the other. The initial investigations are carried out at three variable values: relation of initial geometric beam dimensions, neutralizer length and total area of cryopanels.

34887 (INIS-SU—202, pp 432-437) **To the calculation and optimization of an ion injector focusing system.** Sitina, G.S.; Chuyan, R.K. (Moskovskij Aviatsionnyj Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of simulation of ion beam accelerating-shaping systems in thermonuclear system injectors are puesented. The imitation model represents two groups of modules. The first module group serves for determining electrostatic field in the acceleration space, the second module group is related to calculation of state and wear of electrode surfaces. The accuracy of the results obtained has been compared with the results of analogous simulation in an electrolytic bath and turns to be quite satisfactory.

34888 (INIS-SU—202, pp 459-466) **Powerful generators for plasma Alfven heating.** Kirov, A.G.; Lyashenko, O.N.; Majburov, V.B.; Savchenko, I.S.; Tolpegov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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For plasma HF heating by the Alfven waves a "linear" HF generator is designed where the basic element is an artificial line short-circuited at one end and switched to the consistent loading at the other end. Such a line ensures obtaining in loading two periods of sinusoidal current oscillations. Transistor-diode switches in charge circuits and capacitor discharge are switched in turn. On the mock up obtained are pulse HF oscillations with 3-4 on-off time ratio at the frequency 400 kHz, pulse power about 1,5 kW and transformation efficiency 75%. For obtaining continuous oscillations powers of several generator are added together. The loading is the bridge network. In each bridge diagonal through commutators two artificial lines are switched on. Calculation switch parameters for the generator of 100 MW power at the 1 MHz frequency are given.

34889 (INIS-SU—202, pp 467-474) **Technical peculiarities of plasma ohmic heating at the "Uragan-3" torsatron-stellarator.** Amelin, V.Z.; Burchenko, P.Ya.; Krizskij, V.I.; Pinos, I.B. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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For the purpose of studying plasma with current at the "URAGAN-3" torsatron and obtaining maximum parameters of plasma ohmic heating a highly effective inductor design with a spatial divertor is proposed. The inductor coil fully repeats the torsatron magnetic system configuration. The helical inductor coil turns of copper plates are connected in series and placed on the bottom of power carcasses. Two compensating turns formed of power carcasses of compensation coil and copper rings are connected in parallel. It is shown that despite a strong electromagnetic connection of inductor with the torsatron magnetic system, overvoltages and currents arising in the magnetic system at plasma ohmic heating current excitation can be decreased down to acceptable values by the choice of the corresponding magnetic system power supply or application of capacitor filters.

34890 (INIS-SU—202, pp 475-480) **Optimization of ignition in a torsatron-reactor.** Volkov, E.D.; Rudakov, V.A.; Suprunenko, V.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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With the purpose of search for optimum method of torsatron-reactor output into the combustion regime typical methods of reactor ignition are considered. The following method of plasma production and heating is suggested. Preliminary plasma is produced with concentration of the order of some percent of the operating one and 10 eV temperature. Then heating up to 5 keV temperature occurs after which density storage takes place up to concentrations required for combustion and then further plasma heating up to ignition is carried out. The required for the ignition 300 MW power can be switched on by means of HF modules for example one for each torsatron module. Manufacturing HF modules with power of 10-15 MW order presents no technical difficulties nowadays.

34891 (INIS-SU—202, pp 522-530) **System of HF-energy input into large tokamaks when icr heating.** Alikaev, V.V.; Vdovin, V.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The calculations are given and the design of input system of HF-energy into reactor-tokamak plasma in the course of ion-cyclotron heating is proposed. The input module permits to introduce under stationary conditions 20 MW of HF power. An antenna has a radiating surface 2x2 m and shapes the spectra of axial wave numbers with the required lagging. Two antenna versions are considered: antenna on loop exciters and antenna-resonator. As material for antenna the alloy 95% of vanadium+5% titanium is used. For input of 75 MW of HF power in the course of ion-cyclotron heating into INTOR device four antennas arranged on the external side of the tor in the first wall region are employed.

34892 (INIS-SU—202, pp 59-66) **Development status of technological problems of laser thermonuclear fusion.** Feoktistov, L.P.; Skliznov, G.V.; Rozanov, V.B. (AN SSSR, Moscow. Inst. Vysokikh Temperatur; AN SSSR, Moscow. Fizicheskij Inst.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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With the purpose of designing laser thermonuclear plant (LTP) suggestions of technical character on simulation of conditions in the chamber and blanket of the thermonuclear reactor after the realized microexplosion and analysis of factors affecting the first wall of the reactor are presented. The results of simulation of processes related to absorption of part of thermonuclear microexplosion energy by the surface of the first wall moistened by liquid lithium film are presented. The flowsheet of the developed experimental plant is given which permits to study film rate dynamics, obtain evaporation rate data, investigate the absorption process of microexplosion energy in surface and near-wall layer when the preheating and partial evaporation of the first wall material by the reflected laser and x radiation is to shield the wall surface from α particles and target fragments. For the development of x ray measurements technique a serios of model experiments on studying the laser radiation interaction with the surface of different materials is performed.

34893 (INIS-SU—202, pp 446-453) **Heavy ion accelerator.** Logachev, E.I.; Lopatin, V.S.; Remnev, G.E.; Usov, Yu.P. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The results of experimental investigation of heavy ions production from explosion-emission plasma are presented. The experiments have been performed at the TONUS accelerator comprises voltage pulse generator, double shaping line, two discharges, induction switched to the gun electrode and to the vessel. Two voltage pulses of different polarity with a certain break between them have been applied to the diode gap. The first pulse is intended for creating explosion-emission plasma, the second pulse is an operating one. The delay time smooth control range between the pulses is 200-800 hs. The potential electrode finished with a steel rod of 4 mm diameter, 2 cm length. The interelectrode gap varied from 1 to 300 mm. The earthed electrode in the form of a plane washer of 1-5 mm thickness with 14-25 mm opening diameter has been manufactured from polyethylene teflon, graphite and Li,Al,Fe,Mo and Ta metalls. On the CD_2 target a neutron yield up to $2x10^8$ for a pulse is obtained. It is shown that for each type of ions there exists an optimum value of a break between voltage pulses will ion acceleration efficiency under optimum conditions is higher than in Luce diodes.

34894 (INIS-SU—202, pp 454-458) **High-frequency power supply for plasma heating in toroidal traps.** Longinov, A.V.; Arkatov, I.M.; Berezov, D.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The HF power supply "KEDR" for tokamak T-10 plasma heating in the frequency-band the order of ion cyclotron frequency is described and its testing results are preseneted. "KEDR" comprises HF generator, feeder system, loading equivalent, anode and grid supply systems control and measurement systems. The hFgenerator is designed according to the two-cascade circuit. The mastergenerator is designed on the triode base of GMI-37A type, power amplifier on the GI-56A triode base. Circuit schemes of both cascades represent coaxial resonator. The feeder consists of 12 in parallel connected cables of RK-50-24-17 type "KEDR" testing in the pulse duration regime 40 μs, at the frequency 38 MHz have shown the presence of a considerable storage as compared with design parameters. The power level in the loading equals 12 MW.

34895 (INIS-SU—202, pp 438-445) **Calculation and optimization of electrostatic fields in relativistic electron beam generators.** Budanova, L.A.; Kuleshova, N.G.; Pecheuskij, O.P.; Chetvertkov, V.I. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Novgorodtsev, A.B.; Popova, V.A.; Shneerson, G.A. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results of optimization electrostatic fields calculations in nanosecond high current electron accelerators (NHEA) are presented. The calculation technique is described and the results of fields calculation in accelerator units "Angara-5" and "Parus" are presented. The performed numerical field investigations for NHEA different units have shown the possibility of using for designing accelerator technologicl purposes of analytical plane-parallel field calculations of corresponding typical regions. In case if the field is to be specified the results of such calculations can be used as a perfect initial approximation at numerical optimization calculations.

34896 (INIS-SU—202, pp 489-496) **Intense ion beam production in a ballistic focusing diode.** Bystritskij, V.M.; Didenko, A.N.; Krasik, Ya.E.; Matvienko, V.M.; Tolmacheva, V.G.; Tolopa, A.M. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The results of experimental investigation of intense ion beam (IIB) production in a coaxial magnetic insulated diode are presented. The diode consists of a coaxial external anode of 94-120 mm diameter and internal cathode with longitudinal slits of 12 mm width. Two types of insulating magnetic fields: Bsub(Z)-field created by external solenoid and Bsub(o)-pulse field obtained in the course of current transmission from the external battery along the cathode. In the regime with Bsub(Z)=0,42 T the IID amplitudes for anodes from teflon, copper, lead have reached 3,7, 1, 1,3 kA and densities - 330 A/cm², 87 A/cm², 114 A/cm², respectively. In the regime with Bsub(o)=1 T maximum IIB density on the cathode surface has reached 220 A/cm², IIB maximum current constitutes 10 and 11 kA for the current getting to the cathode ribs and penetrating into slits, respectively. The production efficiency constitutes 67%.

34897 (INIS-SU—202, pp 501-505) **Hollow cathode ion source without magnetic field.** Elizarov, L.I.; Martynov, M.I.; Chesnokov, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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On the base of the IBM-4 ion source a hollow cathode source operating in the continuous regime is developed. The gas discharge chamber diameter equals 100 mm, chamber height - 50 mm. A hollow cathode represents a molybdenum tube with an internal diameter 13 mm and wall thickness 0,7-0,8 mm. An emitter is manufactured from zirconium carbide and lanthanum hexaboride. The investigations of the source operation have shown both cathodes operated efficiency. Electron emission density consitutes 25 A/cm². At the 50 A discharge current ion current density in a center of plasma emitter constitutes 120 mA/cm². As a result of the investigations carried out the compatibility of the hollow cathode and the IBM-type source is shown.

34898 (INIS-SU—202, pp 506-513) **Development of a high-voltage accelerating channel of an ion injector.** Bobrov, Yu.K.; Ierusalimov, M.E.; Il'enko, O.S.; Khominich, V.I.; Shostak, V.A. (Kievskij Politekhnicheskij Inst. (Ukrainian SSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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The purpose of the investigation is simulation and optimization of high-voltage elements of accelerating channel of the hollow beam injector of negative ions. Developed are the algorithm and the program of solution of self-consistent problem of quasistatic field calculation of the injector accelerating channel are developed. The comparison of anlaytical and numerical solutions has shown that the approximate analytical expressions obtained can be used for preliminary calculations.

34899 (INIS-SU—202, pp 497-500) **Hydrogen negative ion stationary source with a hollow cathode.** Elizarov, L.I.; Martynov, M.I.; Chesnokov, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number TI84780274. (CONF-8106209—Vol.1).

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For the purpose of designing the negative ion beam injector for future thermonuclear plants hydrogen negative ion plasma source with crossed· electric and magnetic fields operating in the stationary regime has been designed and investigated. The source basic elements are magnetic system, cesium hollow cathode, accessory and basic anodes as well as ion-optical system. In the ion source the stationary H^- ion beam with 0,1 A current has been obtained. The highest ion current is obtained with the magnetic field equal 10-20 Gs.

34900 (INIS-SU—202, pp 6-22) **Tokamak-15. Basic parameters and design status.** Andreev, V.R.; Bondarenko, I.M.; Bondarchuk, Eh.N. (and others). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

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The description of design state of Tokamak-15(T-15) device intended for producing and studying plasma with thermonuclear parameters is given. The T-15 specific feature consists in using superconductor coils of toroidal field on one Nb_3Sn alloy base and using for heating plasma along with neutral omjection of SHF-waves in the electron cyclotron resonance. T-15 and its system parameters are given. The T-15 nominal operation conditions are calculated for a toroidal magnetic field 3,5 T and plasma current of 1,4 MA. At the second stage of experiments field increase up to 4,5-5 T and current-up to 2-2,3 MA and power increase of plasma additional heating from 10 to 15 MW is planned. The T-15 overall dimensions are as follows: external diameter 10,9 m, height-11 m. Total weight-1500 t. The T-15 comprises the following systems: fast atoms injection system, electromagnetic system power supply, vacuum pumping out and gas leak in system, cryogenic supply system, power supply of additional plasma heating devices, diagnostic complex, T-15 control system, experiment automation complex, magnetic system units test bench and T-15 injector physical process studying test bench. Design of almost all systems is accomplished and partially started T-15 equipment manufacturing. The T-15 investigation program is described.

34901 (INIS-SU—202, pp 23-30) **Computer calculation of electromagnetic chapacteristics of toroidal inductive energy strages with account for a real geometry of the magnetic system.** Kolyadin, N.M.; Kondratenko, A.K.; Kosabova, I.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Yudas, V.I.; Lapionov, A.E. (Moskovskij Aviatsionnyj Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

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The results of numerical calculation of electromagnetic characteristics of toroidal magnetic systems (TMS), assembled of cylindrical sections of round or arbitrary cross section are presented. Four types of algorithms are developed in which as elementary current region thin, twin, thin cylinder, small cross section prism, thin finite length and width plate are employed. Experimental check of correctness and accuracy of mathemaical models contained in algorithms has been performed at the TMS 6-section model with cylindrical sections of the round cross section. In the field of section joining maximum values of magnetic induction, volumetric and linear radial force can be calculated by formulas for continuous toroidal windina with accuracy up to 1-2 %. Mathematical models realized in developed algorithms and programs permits to calculate electromagnetic TMS characteristics with sufficient for practical purposes accuracy.

34902 (INIS-SU—202, pp 143-149) **Thermonuclear power plant with a reactor-torsatron.** Emel'yanov, G.S.; Kantan, V.V.; Semenov, A.A. (Leningradskij Politekhnicheskij Inst. (USSR)) (and others). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

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Main physical preconditions of designing industrial thermonuclear power plant (TNPP) on the pure stationary reactor-torsatron base are reported. Power installation parameters, analysis of main systems and ma+n technical solutions adopted in designing TNPP with the reactor of the above type are presented. Some TNPP technical economical estimations with a reactor-torsatron are given, a TNPP approximate capital investment structure is determined. This consideration is based on a reactor in which burn up is maintained by dissipation of producing α particles. The following main reactor parameters are adopted: total thermal power-10060 MW, plasma radius 2,0 m, aspect ratio 19, plasma temperature 6,8 keV, plasma density $6x10^{20}$ m^{-3} collision parameter 2,0 m, axial magnetic field strength 5,4 T, total first wall thermal loading 4 MW/m^2, β=3 %, number of superconducting winding periods 7. As plasma heating system the HF method of heating on ion-cyclotron frequency is chosen. The reactor modulation principle has been assumed as a basis of TNPP arrangement solutions.

34903 (INIS-SU—202, pp 150-155) **Some considerations on construction of a two-cycle tokamak type thermonuclear reactor.** Glukhikh, V.A.; Dojnikov, N.I.; Monoszon, N.A.; Sadakov, S.N.; Filatov, O.G.; Churakov, G.F. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

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To avoid constructive complications related to divertor usage in tokamak-reactors a modification of classical nondivertor tokamak is proposed by means of which levellinq in time of blanket irradiation by neutrons and cyclicity harmful influence decrease are possible. A tokamak reactor comprises toroidal field windings inside of which two discharge chambers surrounded by a common blanket and protection are placed. Outside the toroidal fietd winding inductor winding and equilibrium winding coils are located. The tokamak reactor operation principle reminds of the two-cycle internal combustion engine operation principle. In such tokamak reactor substantial levelling in time of blanket operation conditions is possible as it is irradiated in turn by neutrons from one or another chamber. The two-cyclicity principle provides the possibility for designing a power tokamak reactor with a rather high utilization factor without a divertor.

34904 (INIS-SU—202, pp 189-195) **Choice of a technique for estimating maximum design accident of a tokamak reactor.** Kochetkov, S.S.; Smetannikov, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

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The problems of the INTOR reactor safety with the purpose of developing the technique for estimating maximum design accident (MDA) are considered. The formula for determining the accident risk as accident probability product by the quantitative measure of the above event consequences is proposed. Main tokamak reactor systems are considered as possible accident situation sources. It is shown that MDA possessing the greatest risk is to be bound

with the magnetic and cryogenic system failures. To abtain acceptable failure frequencies and reliable accident localization in the magnetic field system the autonomous specialized emergency protection (EP) system development is required. Calculations of emergency situations related to the first wall failure have shown that in the case of water first wall cooling, the vacuum chamber pressure upon fracture is to be essentially less tan in the case of usinghelium as coolant. It is shown that the steel first wall structure with a graphite shield permits to essentially increase the first wall reliability factors.

34905 (INIS-SU—202, pp 268-273) **Parametric investigation of a power hybrid tokamak reactor.** Komin, A.V.; Mineev, A.B.; Seko, E.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Kukushkin, A.S.; Kurbatov, D.K.; Orlov, V.V.; Pistunovich, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Karkhov, A.N.; Levental', G.B. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The description of mathematical model and optimization results of the system consisting of a thermonuclear power plant (TNPP) and NPP consuming TNPP breeded plutonium is given. As optimization result the following system parameters are obtained: TNPP electric power netto-1,7-1,8 GW, plutonium production-3,6-3,9 t/year NPP total electric power-7,2-7,8 GW. It is concluded that the system consisting of a hybrid reactor and NPP is competitive if specific capital costs for thermonuclear reactor exceed the NPP costs not more than 2,1-2,9 times. Economic factors of the system practically are constatnt in the 7-10 GW thermonuclear reactor heating capacity range. The optimum thermonuclear neutron flux for the first wall is of the 1 MW/m² order. The magnetic field in the region of magnetic coils location in optimum versions does no exceed 10 T.

34906 (INIS-SU—202, pp 390-392) **PGN,plasma neutron source.** Lipinski, B.; Cryzinski, M.; Jerzykiewicz, A.; Kucinski, J.; Nowikowski, J. (Institute of Nuclear Research, Warsaw (Poland)). 1982. NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The description of the design and results of start up of the plasma generator with Matter-type electrodes reffered to as a neutran source are presented. It consists of a capacitive energy storage, the chamber with electrode set, vacuum system, of the chamber, and a supporting frame. Generator is designed in the form of a cylinder. The basic dimensions of the generator are 1500x1200 mm. The inner electrode diameter was varied from 20 to 25 mm, the distance between electrodes from 12,5 to 15 mm and the electrode length from 86 to 100 mm. Plasma generator was operated at energies of 1,5-3.5 kJ (25-40 kV) with a lifetime af 1.4 μs. The obtained neutron yield was $2x10^7$-$6x10^8$ n/pulse obtained at 4O kV. The generator is intended for studying radiation effects in reactor materials.

34907 (INIS-SU—202, pp 393-398) **Ion source ion-optical system electrodes fabricated by the method of plastic shape formation.** Malakhov, N.P.; Semashko, N.N.; Romanov, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Zhilkin, V.Z.; Pletyukhin, A.S.; Kirpichev, Yu.V. (Voronezhskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

For the choice of optimum technological parameters in manufacturing ion source ion optics electrodes the design of four-roller die is developed and the results of experiments on profiling ion-optical system (IOS) elements are puesented. For obtaining profiles by the rolling method the multistreaM rolling mill system has been designed. In the process of experimental studies the dependence of drawina force and metal pressu e on rollers depending on rollers diameter deforMation degree, countertension and thickness Of pulled billet wall. It is concluded that using of plastic shape formation methods one can obtain element profiles. Profiling of IOS elements made of a molybdenum tube it is best of all to perform by forming in a die with a parting matrix. IOS elements profiling from continuous monocrystalline molybdenum one can carry out by rolling in a two-shaft mill with cut on shafts different cross section streams. The best results in obtaining contour profile for IOS from a continuous monocrystalline molybdenum results in drawing through the four-roller die.

34908 (INIS-SU—202, pp 410-417) **Study on deformation of thick-wall short-circuited solenoids in a strong magnetic field in application to their use in a reactor with plasmoid in ection.** Adam'yan, Yu.Eh.; Shneerson, G.A.; Shutov, V.L. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

For the purpose of investigating the possibility of using pulse linear systems with in ection of colliding plasmoids as a neutron source for subcritical nuclear reactor cylindrical liners deformation in stpong magnetic fields (30-50T) is studied. Lead, copper and brass cylinders of 30-60 mm length with internal diameter from 23 to 40 mm have been investigated. Wall thickness varied from 5 to 20 mm' The inductor made of copper strip with external diameter from 31 to 40 mm permits to produce currents up to 250 kA, which ensures in the inductor-passive liner gap fields up to 70 T. MaximuM velocity which attaing 105 m/s has been recorded. From the comparison of tiMes of attaining maximum on current and field oscillograms in the gap the conclusion is drawn that basic expansion occurs when current in the inductor begins to drop. Variations of external cylinder radii in time are given.

34909 (INIS-SU—202, pp 514-521) **High-Voltage pulse power supply for gyrotrons for ecr heating of a plasma in the T,10 facility.** Alikaev, V.V.; Bajborodov, YU.T.; Popov, I.A.; Titishov, B.N.; Khromkov, I.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274. (CONF-8106209—Vol.1).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

For performing experiments on electron-cyclotron plasma heating in the T-10 facility a complex of four gyrotrons with general power of 800 kW has been designed. The system of high-voltage gyrotron power supply representing high-voltage pulse modulator is described. The modulator scheme represents a capacitance storage with voltage duplication at the operating pulse moment. Basic feature of the scheme is application of the feedback system which controls the stotage discharge process. The coefficient of using the battery equals 40% in the 100 ms duration pulse. The energy stored in the storage is equal 1,2 MJ. The description of schemes of the system of modulator and gyrotrons protection is given. By the described modulator the experiments on investigation of plasma electron-cyclotron heating in the T-10 facility are conducted.

34910 **(INIS-SU—202) Reports 2. All-union conference on engineering problems of thermonuclear reactors. Volume 1.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. 540p. (CONF-8106209—Vol.1). NTIS (US Sales Only), PC A23/MF A01. Order Number DE84780274.

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Separate abstracts were prepared for each of the following papers. (MOW)

34911 (INIS-SU—219, pp 7S-86) **Study on the stressed-strained state and design optimization of the electromagnetic system fOr the "T-15" device.** Vaulina, I.G.; Gusev, S.V.; Monoszon, N.A.; Sivkova, G.N.; Spirchenko, YU.V.; Chvartatskij, R.V.; Churakov, G.F. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Eliseev, V.V.; Pal'mov, V.A. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

An electromagnetic system (EMS) of the T-15 tokamak device is a spatial construction consisting of doughnut and poloidal field coils. The main feature of the T-15 EMS is the use of a superconducting current-carrying element (SCCE) for the doughnut field coil. The multi-turn superconducting coil is enclosed into a steel power casing of a box cross section. To estimate the strength of the power casing of the doughnut field superconductiong coil (DFSC) of the T-15 device, the equivalent stresses are determined according to the power strength theory. The stresses and minimum safety margins in the characteristic cross sections of the DFSC block casing and in the most stressed cylinder cross section, as well as the SCCE relative strains are presented as calculated for three rated regimes. The maximum block displacements in the forced mode with plasma current break are as follows: circuit displacement in the block plane=1.9 mm, displacement perpendicular to the block plane=4.2 mm. The maximum SCCE relative deformation, taking into account the in-service deformation, is 0.28%.

34912 (INIS-SU—219, pp 128-135) **Calculating study an temperature and pressure increase in the channels of superconducting current-carrying elements in the T-15 device during energy removal.** Ivanov, D.P.; Lelekhov, S.A.; Posadskij, I.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Kalinin, V.I.; Konstantinov, A.B. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Methods and algorithms for calculating temperature deformations in large superconductina magnet systems as a result of uncontrolled transition into the normal state are developed. According to a simplified model of the real process the maximum pressure and temperature in the system and time-dependent variations in these parameters are detcrmined. The calculation results satisfactorily agree with the eXperimental data. The developed methods and algorithms can be used for calculating strengths of superconducting current-carrying elements of the circulation systems of superconducting magnets.

34913 (INIS-SU—219, pp 216-222) **Analytical calculation of momentum-free toroidal solenoids with nonuniform current distribution.** Mingalev, B.S. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Formular are obtained for analytical solutions of characteristics of toroidal magnetic systems consisting of coils of finite thickness with a momentum-free form of the axial line. The calculations are aimed at minimizing a relative turn displacement under the action of electromagnetic forces during operation of the magnetic system.

34914 (INIS-SU—219, pp 223-228) **Study on the stresses strained state of a current-carying element of the T-15 device toroidal field coil.** Sivkova, G.N.; Spirchenko, Yu.V. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A method is presented for calculating the voltages and deformations of a superconducting current-carrying element (SCCE) of the Tokamak-15 toroidal field coil. The SCCE is a composite structure consisting of superconductor and insulator layers bound to each other with an epoxy compound. The proposed method takes into account the SCCE and steel case force interactions, as well as the volumetric character of ponderomotive loading, acting in the assembly plane, using the two-dimensional version of the finite element method. Numerical realization of the problem of determining the SCCE stressed-strained state is performed on ES-1040, ES-1022 computers using the "PLATWEC" program. The calculations show the following: 1) the SCCE strains are variable both in the tangential and radial directions, their maxima being epsilonsub(THETA)0.92x10^{-3} and epsilonsub(r)=0.90x10^{-3}, respectively; 2) the SCCE maximum stresses are as follows: the normal tangential stress σΞsub(THETA)=400 kg/cm^2, normal radial stress σΞsub(r)=285 kg/cm^2, shearing stress tausub(rTHETA)=47 kg/cm^2. These values do not exceed the permissible values for conducto.r and insulator materials.

34915 (INIS-SU—219, pp 229-236) **Design and fabrication of the magnetic system for the "Uragan-3" torsatron with a spatial divertor.** Bykov, V.E.; Georgievskij, A.V.; Kitaevskij, L.Kh. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A design and fabrication procedure of the magnet system (MS) of the "Uragan-3" torsatron are presented. The two-stage force-free MS consists of a triplex spiral coil (SC), a compensating and a correcting coils. The accepted MS version has the following design features: a) the magnet system is located in a vacuum volume; b) the spiral coil poles are enclosed in separate carrier cases fixed in a supporting frame; c) the SC pole is filled up with conductor in a multilayer section-like pattern; d) large coil dimensions and high conductor rigidity; e) the availability of a divertor. The explosion technique of SC punch-free stamping is described in brief. The conclusion is made that the developed special manufacturing methods have permitted to design a reliable torsatron system with a spatial divertor to a sufficient accuracy and with high parameters.

34916 (INIS-SU—219, pp 251-257) **Design problems on development of the system for plasma filament position fast control in the T-15 device.** Bondarchuk, Eh.N.; Karnaukh, V.A.; Ostroumov, Yu.N.; Pravdin, A.H.; Suvorov, M.M.; Shmal'ko, G.I.; Churakov, G.F. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A design of a fast response control coil (FRCC) of the T-15 device is given, the use of which compensates fast disturbances of the equilibrium filament position through the control system feedback. To uncrease the FRCC effect on plasma, it is maximally approximated to the plasma, i.e. it is located in the toroidal ring cavity between the vacuum chamber and superconducting toroidal field coils (STFC). The internal shield decreasing the heat flux coming from the vacuum chamber to the STFC both in operating conditions and chamber heating is also described. In the operating mode the shield is cooled by nitrogen circulating in a pipe soldered up to the shield envelope.

34917 (INIS-SU—219, pp 297-306) **Study of the cooling conditions and thermal characteristics of superconducting magnetic system of the "Kristall-2" torsatron.** Glasov, B.V.; Druj, O.S.; Kurnosov, V.I.; Skibenko, E.I.; Skrypin, S.I.; Yuferov, V.B. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A design and operating conditions of a superconducting magnetic system (SMS) of the "Kristall-2" triplex torsatron with 60 cm long torus radius are described. The SMS cooling flowsheet,

temperature dependence of SMS thermophysical parameters, SMS cooldown and coolup dynamics and energy expenses for attaining the operating temperatures are presented.

34918 (INIS-SU—219, pp 307-314) **Results of analysis of the poloidal magnetic system and operation regimes of the "T-15" device.** Bondarchuk, Eh.N.; Dojnikov, N.I.; Shmal'ko, G.I. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Operation of the poloidal magnetic system of the "T-15" device under normal and boosting conditions is analysed. The calculation results for physical processes in the inductor coil and control coils are presented. Currents in the poloidal coil system providing the discharge evolution in the plasma filament and maintaining its equilibrium during the whole discharge period are given. Magnetic-flux linkage with coils and electrodynamic forces acting on them, as well as induction values for the core and pillars are also considered.

34919 (INIS-SU—219, pp 289-296) **High-temperature electrical insulators for electrophysical devices.** Buzhinskij, O.I.; Lopatin, V.V.; Ushakov, V.Ya.; Chernenko, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Tomskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The main physical properties of ceramics that meet the strict requirements for electric insulators used in hot areas of thermonuclear devices are presented. In particular, the properties of some oxiden ceramics of BeO, Al_2O_3 and ZrO_2, as well as nitride ceramics of BN, AlN and boron pyronitride are given. The results of experiments and experience on nitride ceramics permit to make a conclusion as to the expediency of their utilization as high-temperature electric insulators.

34920 (INIS-SU—219, pp 136-143) **Protection system of the immersed-type superconducting magnet system at accidental loss of superconductivity.** Shaposhnikov, V.A.; Mikhajlov, I.I.; Gorbachev, S.P. (Nauchno-Proizvodstvennoe Ob"edinenie Kriogennogo Mashinostroeniya, Balashikha (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A heat protection system of superconducting magnets for protecting against aftereffects of accidental superconductivity loss is developed. The system permits to solve the problem of collecting helium evacuated from the cryostat in the emergency situation. The heat protection is based on the hydraulic lock prnciple. The magnet coil located in the cryostat is fully immersed in liquid helium. The coil is surrounded by an impermeable shell at the top and at the sides. The shell has at the bottom part the ways for free access of liquid helium to the coil and at the upper part - the channel with limited transmissibility for removing helium vapours produced under normal operating conditions of the magnet. In case of an emergency heat release in the coil the vapour generation shaply increases. The vapours displace liquid from under the shell into the free cryostat space, and thus the coil gets surrounded by the gas. The conditions of heat transfer from the coil to liquid in this case deteriorate greatly, and it is possible then to pump helium removed from the cryostat into receivers using usual pumping units instead of blouring helium off into the atmosphere. The normal phase quickly propagates along the coil providing a uniform heat evolution over the coil volume and excluding the possibility of a burnout. To check the heat protection system efficiency comparative experiments have been carried out on a magnet simulator with a single protective shell and without heat protection, with the gas re– lease from the cryostat closed. The heat protection is found to reduce the heat flow transferred from the magnet simulator to the cooling liquid by more than an order. The experiments have confirmed the efficiency and reliability of the heat protection system, correctness of physical concepts of the calculation method as well as authenticity of the method.

34921 (INIS-SU—219, pp 186-192) **Study on the conductor-insulator friction at liquid helium temperature.** Batakov, Yu.P.; Kostenko, A.I.; Semenov, O.V.; Trokhachev, G.V. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number TI84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A study is made on conductor heating as a result of friction following displacements under coolina conditions close to those for conductors in superconducting magnets with cryostatic stabilization. Sliding of a 2x15 mm^2 copper plate an averawithge surface roughness of 1m over fiberglas0 μ textolite and teflon is studied. "Sudden" displacements are caused by application of the displacing force exceeding the static frictional force several times. If in case of friction displacements.are caused by the action of a force equal to the static frictional force, stops increasing the displacement time are possible. This may ta.ke place following the displacement of the conductor parts in the superconducting magnet coils, owing to which the displacement may turn out to be not "sudden". In this case in designing superconducting magnets the tolerances for conductor portion displacements, which do not affect the magnet normal operation, may be less strict.

34922 (INIS-SU—219, pp 17-22) **Synthesis of the plasma eqUilibrium system in a tokamak reactor at inaccurate basic data.** Dojnikov, N.I.; Filatov, O.G. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A problem of plasma equilibrium system synthesis in a tokamak reactor is considered which consists in determination of th currents across the system coils. Since it is necessary to make some or other assumptions on parameters characterizing plasma, such a problem is considered as a synthesis problem at inaccurate initial data. The Tikhonov regularization method is used for solving the problem. For numerical realization of the above method the TOPOL code is developed. The problem is solved by method of successive approximations. At every iteration step (over the plasma current distribution) the functional is minimized with choosing the regularization parameter. Such a solution is shown to be stable to inaccuracy of the initial data.

34923 (INIS-SU—219, pp 23-30) **Force-free magnet system of the "Uragan-3" torsatron.** Georgievskij, A.V.; Koryavko, V.I.; Litvinenko, Yu.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.); Kornilov, G.L.; Naryzhnyj, A.G. (Khar'kovskij Aviatsonnoj Inst. (Ukrainian SSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Formulation and solution results of a problem are outlined for determining free parameters of the U-3 torsatron magnet system, the parameters complying with the "force-free" state of a spiral coil. The results of calculations of electrodynamic forces in the magnet system are given and mechanical strength of the latter is estimated. The analysis has shown that the main factor defining the ultimate field of such systems is the biaxial compression forces in the spiral coil. According to conditions of the "U-3" spiral coil yield strength, the limiting field is 7T. The conclusion is made that the problem solution for further magnetic field increase should be sought for by decreasing the stressed state level of pole compression, e.g. by realizing a design close to all-round compression.

34924 (INIS-SU—219, pp 31-38) **Divertor configurations of the torsatron magnetic field.** Bazaeva, A.V.; Bykov, V.E.; Georgievskij, A.V.; Peletminskaya, V.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Results of a detailed investigation of characteristics of the divertor magnetic fluxes are given. The investigation is carried out by mathematical simulation of large poles of the magnetic system with a modulated (equally inclined) three start spiral coil at high toroidality. Each pole of the spiral coil is simulated by 20 current filaments. The compensating coil is defined in the form of two axisymmetric rings. The equilibrium field H is assumed homogeneous in the whole volume studied. At the first stage the magnetic surface parameters are determined versus the H value. They are shown to be rather high. At the second main stage near-separatrix areas are studied; they are characterized by the presence of destroyed surfaces the field lines of which form the divertor layer. A method is developed and the behaviour of the above field lines is studied, which permits to determine the spiral spatial divertor magnetic field configuration. The divertor flux distribution is studied experimentally using a torsatron magnet system model. The magnetic flux distributions agree with the calculations mainly.

34925 (INIS-SU—219, pp 68-77) **Electromagnetic system for the "T-15" device.** Bondarchuk, Eh.N.; Dinoburg, L.B.; Dojnikov, N.I. (and others). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

An electromagnetic system (EMS) of a large demonstrational tokamak T-15 is described. The T-15 device is designed for generating and studying plasma with parameters close to thermonuclear ones. The design and characteristics of the EMS with a toroidal field superconducting winding made on the Nb_3Sn base are given. The T-15 device design is completed and its construction is started.

34926 (INIS-SU—219, pp 94-103) **Study on the properties of a superconducting current-carrying element and its stability to pulsed poloidal fields in the "Tokamak-15".** Ivanov, D.P.; Kejlin, V.E.; Kovalev, I.A.; Lelekhov, S.A.; Pozvonkov, M.M.; Posadskij, I.A.; Cherpoplekov, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

To ensure stability of supercondUcting current-carrying elements (SCCE) two versions of cooling toroidal field superconducting coils (TFSC) are studied experimentally. Using a SCCE model the dependence of the critical current Isub(c) on the temperature T and magnetic field B is studied. The relationship Isub(cr)B=f(T) confirms that the SCCE transition to the normal state is a result of the critical current rather than of local heat releases related for example with turns displacement. It is found from the experimental and calculated results that, at the flow rates close to the nominal values in T-15, the two-phase helium coolina is preferable. It follows from calculations and experiments that, when the SCCE rated parameters are achieved (Isub(cr)=8 kA in the 8.5 T field, operating current =5 kA) under the T-15 nominal operating conditions (plasma current =1.4 MA), current blowouts will not lead to transition of the superconducting magnet system to the normal state, however, under the forced conditions (plasma current =2.3 MA). the SCCE stability to plasma current blowout will not be provided and extra protection of the toroidal field coils is reguired.

34927 (INIS-SU—219, pp 104-111) **Device for normal phase detection in a toroidal-field superconducting coil of the "Tokamak-15" device.** Dubasov, V.G.; Zhelamskij, M.V.; Trokhochev, G.V. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Specifications are formulated and a structural diagram is described of the normal phase detection device (NPDD) developed for the Tokamak-15 protection system. Besides the protection functions in the NPDD of the T-15 tokamak device, the possibility of cut-off or decrease in the feeding current in the toroidal field superconducting coil (TFSC) specified, if the normal phase (NP) propagates slowly along the coil or exists in the limited ranges. The NPDD is based on determining the voltage across the ohmic resistance of the TFSC sections converted to the normal state. In that case the protection system performs two functions. The first one is to detect the NP at a high NPDD sensitivity, while attempting to restore the superconductivity by changing the TFSC current regime. The second function to exercise a protective power lead out from the TFSC when the current changed has not lead to a NP "collapse " and reached the level permissible by heating. The NPDD of the T-15 device provides detection of a NP signal in the protective extraction mode at the 100-500 mV level, in the control mode - at 2-50 mV at +-0.5 V noise voltage. The detection time is chosen within the 0.01-0.5 s range depending on the noise duration; high voltage decoupling is up to 3 kV. The availability of a back-up channel and an emergency protection channel with a follow-up control of the state of the main NPDD units and appropriate alarm system ensures a hiah system reliability.

34928 (INIS-SU—219, pp 112-120) **Cryogenic system for the "Tokamak-15" device.** Barmin, N.V.; KoValenko, V.D.; Korshunov, Yu.N. (Nauchno-Proizvodstvennoe Ob"edinenie Kriogennogo Mashinostroeniya, Balashikha (USSR)) (and others). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A cryogenic system (CS) is described for the "Tokamak-15" device which provides for cooling of the toroidal field superconducting coil (TFSC), superconducting magnets of the SHF plasma heating system generators, the cryovacuum exhaustion system of in ectors, as well as a number of cryogenic devices to be cooled down to nitrogen temperatures. Functionally the CS is divided into a helium cryogenic system (HCS) and a nitrogen cryogenic system (NCS). The two-circuit HCS ensures rather high thermodynamic efficiency: the specific power consumption for producing 1 W of cold at the 3.5-4.5 K temperature level does not exceed 400 W and for producing 1 l of liquid helium is not more than 1.3 kWh. The NCS is intended for cryostatic cooling of a number of cryoresistive objects: an inductor coil, a control coil, a horizontal and a vertical control field coils. Besides, the NCS provides cooling of heat insulating shields of the Tokamak-15 cryostat, injectors, HF heating system, helium- and current lead-in unit. Cryostatic cooling of cryoresistive and heat insulation shields is provided by circulation technique.

34929 (INIS-SU—219, pp 121-127) **StructUre and test results of the Tokamak-7 device cryogenic system.** Babaev, I.V.; VolobUev, A.N.; Zhul'kin, V.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii) (and others). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A cryogenic system (CS) of the Tokamak-7 (T-7) installation with the longitudinal field superconducting magnetic system (SMS) is described. The CS is designed for cool-down, cryostatic cooling and heating of the T-7 cryogenic objects and consists of a helium system (HS) and a nitrogen cryogenic system (NCS). The HS consists of:a a heliUm delivery system intended for distributing and controlling the helium flows in the SMS; cryogenic helium units; a 1.25 m^3 volume for storing liquid helium; a compressor compartment using piston compressors at the 3 MPa operating pressure and 140 g/s total capacity; gaseous helium storages (3600 m^3 under normal conditions); helium cleaning and drying systems; a gas holder of 20 m^3 operating volume; cryogenic pipelines and pipe fittings. The NCS operates on delivered nitrogen and includes a 120 m^3 liquid nitrogen storage, evaporators and electric heaters producing up to 230 g/s of gaseous nitrogen at 300 K, a separator, cryogenic pipelines and fittings. It is found that the CS has the necessary cold production reserve, ensures reliable operation of the Tokamak-7 device and permits to carry out practically continuous plasma experiments.

34930 (INIS-SU—219, pp 159-166) **Main design elements of the superconducting magnet for the LIN-5B baseball trap.** Arsent'ev, V.F.; Bezbatchenko, A.L.; Golovin, I.N.; Panov, D.A.; Chukhin, I.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A design of superconducting magnet system (SMS) is described for the LIN-5B baseball trap elaborated for the OGRA-3B experimental installation. The general layout of the trap, cross sections of the superconducting coil and load-bearing frame, the current leads arrangement and main LIN-5B SMS parameters are presented. A three-year experience in operation of the baseball LIN-5B SMS and successful tests followed by achieving critical conditions four times permit to make the conclusion that the design and SMS assembly meet the requirements.

34931 (INIS-SU—219, pp 167-170) **Thermal conductivity coefficient of materials for superconducting magnet system of the T-15 device.** Deev, V.I.; Panteleev, E.A.; Sobolev, V.P. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The results are presented of eXperimental determination of thermal conductivity of some materials used in one of the versions of the T-15 toroidal magnetic field superconducting coil. The material of the coil body (Kh18N10T stainless steel), electric insulating gaskets of fiberglass laminate, electric insulating material (several layers of varnished cloth impregnated with binding compound used as interturn electic insulation) and separate parts of the cuurrent-carrying busy As regards the bus, the data are obtained on the thermal conductivity coefficient for the coolant pipe (M2 copper), bus body material (electrolytical copper), superconducting cable of nine NT-50 wires with copper coating and for the bus cross section. The thermal conductivity coefficient measurements are carried out on experimental installations using the stationary method of axial heat flux in the 4-300 K temperature range. The measurement error does not exceed 6%.

34932 (INIS-SU—219, pp 171-177) **Study on thermal process in superconducting magnet system of the "T-15" device.** Vakhnenko, B.A.; Deev, V.I.; Merinov, I.G.; Filippov, A.V. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Numerical calculations are carried out of thermal processes in the superconducting magnet system (SMS) of the T-15 device in the cool-down and cryostatic cooling modes. To perform thermohydraulic analysis a mathematical model is elaborated for cooldown of one of the helical SMS bus groups connected parallel to the coolant flow. The model is based on a combined solution of the one-dimensional equations of energy and momentum for a one-phase coolant and the thermal conductivity equation for the bus. The equation system is solved numerically using the developed FIL-2 and FIL-3 programs. The distributions of the bus temperature, coolant temperature and peressure during cooldown, and those of the helium pressure and temperature along the bus length under conditions of cryostatic cooling are presented. The calculations have shown that in case of sufficiently long (seconds) and extended (tens of cm) sources the evolution of thermal disturbance is defined rather by properties a coolant than of bus materials.

34933 (INIS-SU—219, pp 178-185) **Calculation of hydraulic and temperature characteristics of cryoresistive coils of the "T-15" device with account for heat transfer between coil layers in the regimes of preliminary cooling and cryostatic cooling.** Volkov, A.F.; KonstantinoV, A.B.; Kalinin, V.V. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Problems are considered of circulation cooling of cryore--sistive coils of the "Tokamak-15" device electromagnetic system under pulsed thermal loading conditions. An analysis of the temperature state of the cryoresistive two-layer coils has shown that the interlayer heat transfer inside the coil produces a considerable effect on the cooling efficiency. The results obtained have permitted develop recommendations for required dimensions of the cooling channels in the current-carrying element, interlayer insulation thicknesses, coolant flow-rates, which provides for reasonable designing of cryoresistive coils of the Tokamak-15 electromagnetic system.

34934 (INIS-SU—219, pp 193-198) **Magnet systems for superconducting induction-type power storages without external fields.** Egorov, S.A. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Magnetic systems (MS) of superconducting induction-type power storages are analyzed numerically. The MS with active current shielding and a great number of compensated harmonics of external field expansion are considered. The MS principal and shielding coils have the form of cylindrical solenoids. In such MS there is no significant magnetic field in the close vicinity of external coil surfaces and the problem of securing the turns is solved rather easily. The calculations have shown that for the optimal as regards the superconductor consumption, rather short systems (with the section number in the shielding coil greater than 30-50) the external field in the immediate proximity of the external surface of the shielding coil does not exceed 0.01-0.02% of the maximum induction of the system, and it decreases with the section number increase. For systems with a planar butt end "magnetic plugs" the optimum length of the shielding coil exceeds the length of the principal coil of the D diameter by (1 to 1.5)D. Then the axial forces acting on the butt end sections of the shielding coil (butt end "magnetic plugs") become small, and the total force compressing the principal coil decreases approximately 1.5 times in comparison with the ellipsoidal coils.

34935 (INIS-SU—219, pp 199-205) **Study on the pulsed superconducting solenoids development.** Egorov, S.A.; Kostenko, A.I.; Monoszon, N.A.; Tishchenko, V.A.; Trokhachev, G.V. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The problems of designing pulsed superconducting solenoids conserving the superconductivity in cyclic operatio.n at high rates of magnetic field changes, as well as in case of fast energy extraction are considered. The work is aimed at designing superconducting induction-type energy storages for power supplies of pulsed thermonuclear devices and superconducting poloidal coils of tokamak installations. To develop the design of intensively cooled coils coated with compound, to study their thermophysical properties and determine the ultimate, as to the superconductivity conservation conditions, rates of magnetic field variation, two pulsed solenoids of 20 and 200 kJ, respectively, 4 kA curremnt and 4 T magnetic induction are designed and tested. The solenoids are wound with multiwire transposed superconducting cable 6 mm in diameter of 36 superconducting and 13 copper insulated wires of 0.5 mm diameter. The dependence is given of the current for solenoids transition to the normal state on the rate of the solenoid charging and discharging. The tests confirm the possibility of rapid energy ex-

traction from a two-section solenoid with current doubling using two superconducting switches.

34936 (INIS-SU—219, pp 206-209) **Destruction of single-tupn solenoids by a strong pulsed magnetic field.** Churaev, V.A.; Dashkina, S.I. (Leningradskij Politekhnicheskij Inst. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

Conditions of typical destruction of single-turn solenoids following generation of strong- and superstrcng pulsed magnetic fields - the so-called "slow skin-layer explosion" are analyzed. Destruction is a metal outburst along the solenoid axis and depends on the ultimate mechanical stress of a solenoid metal cut. To define criteria characterizing appearance of the "slow-skin-layer explosion", the equilibrium conditions of a surface layer partion of unit width having thickness equal to the depth of magnetic field penetration into metal are considered. Comparative evaluations of stability of different metals against destructions of such type are carried out. The maximum lengths are presented of the internal surfaces of solenoids without destructions for the following materials: VR-27VP alloy, Ta+3.6%Re alloy, VM-1 alloy, MR-47VP alloy, W, Mo, Zr, Cr, Ta, Nb.

34937 (INIS-SU—219, pp 237-244) **Magnetic surface parameter control by means of a transverse magnetic field in stellarators and torsatrons.** Bazaeva, A.V.; Bykov, V.E.; Georgievskij, A.V.; Peletminskaya, V.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The possibility is analysed of controlling parameters of the stellarator and torsatron magnet surfaces by adding a transverse (relative to the torus plane) magnetic field B to the toroidal magnetic field as applied to triplex devices of high toroidality with different (modulated) laying laws. Numerical solutions are carried out on a BESM-6 computer, and the magnetic field is calculated according to the Biot-Savart law. It is shown that in the torsatron with a modulated spiral coil the conditions for optimal magnet surfaces coincide with a simultaneous presence of "min B" approximately 10% and a rather high approximately 0.2 "shear". This fact is one of the most important advantages of a torsatron with a modulated spatial spiral coil. The torsatron magnet configuration with a modulated spiral coil proves to be more stable to the transverse field action in comparison with stellarators.

34938 (INIS-SU—219, pp 258-264) **Development and study on putties for cryogenic coils of the "T-15" thermonuclear device.** Stepanov, A.N.; Chemokhud, L.M.; Shirshova, T.M. (Spetsial'noe Konstpuktorskoe Byuro Sinteticheskoj Izolyatsii); Barantseva, G.E.; Studennikova, A.G. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The paper deals with the development and study on putties intended for smoothing out the surfaces and scaling cryoresistive conductors and superconductors in the electromagnetic system coils of the "T-15" tokamak devices. The studies covered the effect of the putty compositions on electric insulating, mechanical, technological propertieS, as well as the determination of their resistance to thermal shocks and subsequent changes in the properties. The objects of the studies are putty compositions produced on the base of epoxy dianil resin hardened by isomethyltetraphthalic acid anhydride. Boron nitride, talc, grinded mica, boron carbide and their mixture are fillings. An analysis of the experimental data permits to make conclusion that among the studied putty compositions most suitable, according to the set of properties, for smoothing out the superconducting surfaces in cryogenic coils is a putty on the base of EhD-22 resin with the filler of a mixture of ground mica and tals. This putty has high mechanical and electrical strength parameters, satisfactory technological properties. After hardening it permits to get a solid insulation system. The putty mechanical strength losses after 150 thermal chock cycles are 10-20%.

34939 (INIS-SU—219, pp 265-273) **Study on the stress-strained state of the toroidal field coils of tokamak type devices.** Bortovoj, V.V.; Kolomak, V.D.; Lavinskij, V.I.; Khavin, V.L.; Shergin, S.Yu. (Khar'kovskij Politekhnicheskij Inst. (Ukrainian SSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A method of numerical analysis of the stressed-strained state (SSS) of curved rod systems is proposed. On the basis of the method the SSS of toroidal field coils of a large tokamak are studied. The given distpibutions of internal force factors permit to determine dangerous cross sections. The stresses in the dangerous cross section points can be calculated according to the theory of a small curvature bar rather easily. The given analysis of SSS of the toroidal field coil permits to pass over to the problems of rational designing connected with the problem of the joint unit unloading.

34940 (INIS-SU—219, pp 274-280) **Weight optimization of a coil of the electromagnetic system of the TB-O device.** Bortovoj, V.V.; Garev, O.L.; Grinev, V.B.; Lavinskij, V.I.; Khavin, V.L. (Khar'kovskij Politekhnicheskij Inst. (Ukrainian SSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

To optimize the magnet coil designs for large tokamaks, the optimum coil configuration is calculated. The coil is modelled as a flat curved bar of small curvature with the reduced rigidity characteristics, which is loaded with ponderomotive forces. The accepted mathematical model permits to formulate the optimization problem already at the designing stage and so to reasonably choose the design parameters. The optimization effects for a curved bar are attained by redistributing the curvature radius, the radius size being restricted by some design factors. The optimum outlines of a curved bar are calculated. The calculations confirm the validity of the technique suggested.

34941 (INIS-SU—219, pp 281-288) **Study of the magnetic fields of the electromagnetic system of a tokamak without a shell.** Ermilov, I.V.; Kubarev, L.P.; Igonin, G.V. (Vsesoyuznyj Ehlektrotekhnicheskij Inst., Moscow (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The experiments are aimed at studying on a model of magnetic fields generated on tokamak-type devices without shells and comparing the data obtained with the calculations. The following problems are studied: the magnetic field induction in the vicinity of the discharge chamber for different inductor types under no-load operating conditions, the deviation of the magnetic field generated by different coils from the axisymmetric one. The model magnetic system is an O-shape yoke contour of 400 cm^2 cross section into which inductors of different types are installed. The magnetic field induction is measured at alternating current by induction transducers in the form of 6x1.5 mm coils. The magnetic field for the control coil, without the magnetic system core is also numerically calculated. Calculations are carried out for a magnetic system of shell-type. The steel magnetic permeability of the upper and lower yokes is taken as infinity, and for the ¹. core and side yokes is taken from the experimental data. The magnetic system yoke discontinuity is not taken into account. The deviation of calculated data from the experimental measurements in the magnetic core "window" for Z=0 plane does not exceed 10%. The field in and outside the "window" of magnetic system with different inductors is studied in detail. The calculation results agree with the experimental data.

34942 (INIS-SU—219, pp 46-53) **Magnet system of the "AMBAL" experimental trap with ambipolar mirrors.** Dimov, G.I.; Lysyanskij, P.B.; Tadber, M.V.; Timoshin, I.Ya.; Shrajner, K.K. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

A magnet system of the "AMBAL" ambipolar trap under construction is described. The trap magnetic field configuration, geometry of the main coils and diagram of the whole device magnet system are outlined. Drift surface cross sections in the equatorial plane of the ring mirror device, in the median plane and at different distances from the trap median plane are presented. The magnet system design is described in brief.

34943 (INIS-SU—219, pp 61-67) **Two-winding inductor for a tokamak reactor.** Monoszon, K.A.; Sadakov, S.K.; Suvorov, M.M.; Churakov, G.F. 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The main parameters are compared of the inductor windings of a large experimental tokamak T-15 and a promising tokamak reactor INTOR. The INTOR inductor will have two windings - a superconducting one, capable of generating and sustaining the main magnetic flux of the inductor and a cryoresistive one, operating only for a short time at the discharge start and providing fast changes of the magnetic flux necessary for initiating the plasma current. The cryoresistive inductor winding in the INTOR reactor permits to reduce the maximum rate of the magnetic field changes in the superconductor from 18 T/s to 3-5 T/s, i.e. down to the level acceptable for the present-day superconductors. The magnetic field level in the superconducting winding is also somewhat decreased. Besides, a possibility of extra voltage boosting in tracing the plasma path at the moment of discharge initiation, which must expand the experimental potentialities of the installation. The two-winding inductor concept considered is accepted as the basic one for further design studying of the International INTOR reactor project.

34944 (INIS-SU—219, pp 245-250) **Strength-limited magnetic field intensity of toroidal magnet systems fabricated or the base of layer-by-layer shrouded solenoids.** Litvinnko, Yu.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780219. (CONF-8106209—Vol.2).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

The possibilities, as to the ultimate magnetic field strength, of tokamak magnet systems made on the base of layer-by-laeyer shrouded coils are considered numerically. The toroidal magnet system is considered which consists of N skewe, layer-by-layer shrouded, equistrong coils in the ideal torus approximation. The dependences of the ragnetic field strength on the internal- and external torus radii, pulse duration and aspect ratio for copper coils shrouded with fiberglass are calculated as an example. The analysis of the obtained results shows that using of the layer-by-layer shrouding scheme for toroidal solenoid coils leads to a considerable growth of the ultimate magnetic field strengths in a wide duration range. For example, the limiting field strength along the toroidal solenoid axis of the considered type inside the "FT" installation toroidal solenoid at equivalent field pulse duration of approximately 0.3 s reaches $H_0 = 1.3zx10^7$ A/m.

34945 **(KFK—3563) Muonic and polarized fusion for inertial confinement fusion.** Seifritz, W.; Goel, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Nov 1983. 7p. (EIR—499; CONF-830632—). Special print from Atomenerg. Kerntech. (1983) v. 43(3) p. 198-202.

From 3. international conference on emerging nuclear energy systems; Helsinki, Finland (6 Jun 1983).

It is investigated whether or not the application of two novel concepts could facilitate the ignition of DT-pellet in the inertial confinement technique of fusion: The muonic fusion catalysis and the idea of polarized fusion. It seems that due to the overall energetics and inefficiencies involved the muonic fusion catalysis has no chance for a practical application and that in the case of the utilization of polarized DT-fusion material either for the spark region or in the highly compressed cold outer shell or in both pellet-regions the "gain of the gain" is only marginal. The driver energy requirement by the use of polarized fuel can, however, be reduced by a factor of 2.

34946 **(LBL—16890) Spot heating calculation for a heavy ion driven high temperature experiment.** Lee, E.P.; Mark, J.W.K. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013879.

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An analytical model is used to predict the temperature reached in a spot heating experiment driven by a heavy ion beam. A discussion of physical processes and approximations is included. 10 references, 9 figures, 3 tables.

34947 **(MPQ—79) Heavy-ion driven inertial confinement fusion.** Arnold, R.C. (Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)). Oct 1983. 41p. Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.).

Heavy-ion induced nuclear inertial fusion is a promising technology for electrical power generation. In common with other nuclear fusion reactor concepts, HIF would provide an inexhaustible energy supply, without fear of catastrophic failure modes, ultimately using raw material for fuel which is available in all regions of the world in sea water. Research and development required for the driver is of reasonable scope. The fuel cycle and reactor development would be comparable to any other method for fusion power. Target design will require detailed experiments, but at the present time the available information from all sources leads to gain estimates which would suffice for power production with driver energies of a few MJ.

34948 **(MPQ—80) Charge-changing ionic collisions as a method for increasing specific deposition energy in heavy ion drivers.** Arnold, R.C. (Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)). Oct 1983. 23p. Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.).

The ring-fill times estimated should be increased; a facotr of vsub(REL)/v_0 should be included, on page 8, multiplying f_{43}, where vsub(REL) is the relative (cente-of-mass) collision velocity between the two beams, and v_0 the velocity of the fastest incoming beam. This change corrects for the fraction of collision path length available to each incoming ion as it traverses the interaction region (in the laboratory frame). This would increase the fill time by a large factor if the same kinematic choices were made. Instead, we will choose to make the relative H-C velocity approximately 1 x 10^7 cm/s, while keeping the spread in C velocities small to avoid intra-beam collision losses. In this case f_{43} proportional 10^{-7}, and in the following line on page 8 we would have "10^{-7} pmA of C^{3+}". On page 9, tausub(FILL) is increased to 6 sec., which corresponds roughly to 10^7 turns. The first three lines on page 12 should be changed to read "... tau_1 proportional 10^{-1} sec. we find tausub(FILL) proportional 10^2 sec., which may be tolerable with sufficiently good vacuum. (This time estimate is based on an interaction length of 10 M, and higher currents than in the previous example.)" On page 6, following the first reaction formula, the rest of that sentence should read "at collision velocities of order 10^7 cm/sec." The following sentence should be deleted.

34949 **(NRL-MR—5225) NRC survey on plasma physics and fluids fusion plasma confinement and heating. Chapter 8. Inertial confinement fusion.** Ripin, B.H.; Kruer, W.L. (Naval Research Lab., Washington, DC (USA)). 18 Jun 1984. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013291.

A survey of inertial confinement fusion research is presented; current issues are emphasized.

34950 **(ORNL/TM—8976) Neutronic evaluation of fissile fuel breeding blankets for the fission-suppressed Tandem-Mirror Hybrid Reactor.** Johnson, J.O.; Burns, T.J. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013624.

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A computational study was performed on the blanket design of the Lawrence Livermore National Laboratory (LLNL) fission-suppressed Tandem Mirror Hybrid Reactor (TMHR) to qualify the methods and data bases available at Oak Ridge National Laboratory (ORNL) for use in analyzing the neutronic performance of fissile fuel breeding blankets. The eventual goal of the study was to establish the capability for analysis and optimization of advanced fissile fuel production blanket designs. Discrete ordinates radiation transport calculations were performed in one-dimensional cylindrical geometry to obtain the blanket spatial distribution and energy spectra of the neutron and gamma-ray fluxes resulting from the monoenergetic (14.1 MeV) fusion first wall source. Key macroscopic cross sections of the blanket materials were then folded with the flux spectra to obtain reaction rates critical to evaluating blanket feasibility. Finally, a time-dependent depletion analysis was performed to evaluate the blanket performance during equilibrium cycle conditions. The results of the study are presented both as graphs and tables.

34951 **(ORNL/TM—9203) ORACT: a 174-neutron-group activation cross-section library for fusion and fission reactor design studies.** Santoro, R.T.; White, J.E.; Drischler, J.D. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013603.

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A 174-neutron-group activation cross-section library for 233 ground-state target isotopes and 22 isomeric target isotopes is described. The library, ORACT, was derived from the ACTL Evaluated Neutron Activation Cross-Section Library and was developed for use with existing computer codes that calculate induced activation by convoluting the cross-section data with neutron scalar flux distributions. The activation cross sections extend over the energy range from thermal to MeV and are useful for fusion and fission reactor nuclear design studies as well as other applications.

34952 **(PPPL—2112) Application of toroidal multipoles to facilitate tokamak reactor studies.** Ehrhardt, A.B. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1984. Contract AC02-76CH03073. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013080.

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A method of calculating the vacuum magnetic flux for plasma equilibrium over a range of aspect ratio A and major radius R is presented. Toroidal multipoles are used to fit the vacuum flux for a set of reference equilibria and the fitted moments are then used to parametrize the flux over the design space in A and R. An example is given in which the equilibrium flux for a D-shaped tokamak plasma is predicted and compared with the actual equilibrium code vacuum flux.

34953 **(SAND—83-2629C) Measurement of retained hydrogen by laser thermal desorption for carbon exposed to sub-eV atomic deuterium.** Davis, J.W.; Haasz, A.A.; Auciello, O.; Stangeby, P.C.; Doyle, B.L. (Toronto Univ., Ontario (Canada). Inst. for Aerospace Studies; Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 16p. (CONF-840520—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012277.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

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Retention levels for sub-eV D^0 atoms in single crystal and pyrolytic graphite were measured using a newly-developed Laser Thermal Desorption (LTD) technique. Retention levels for single crystals were ~ 3 x 10^{13} D^0/cm^2 for incident fluences of ~ $10^{19}D^0/cm^2$. This is about two orders of magnitude lower than D^0 retention in pyrolytic graphite, and correlates very well with the differences in effective surface areas. The D(^{3}He,p)^{4}H/sub e/ Nuclear Reaction Analysis (NRA) was used to confirm retention levels as measured by the LTD technique. A further finding was the influence of a small layer of evaporated tungsten on the sample surface. Such W impurity resulted in an increase of D^0 retention of up to a factor of ten.

34954 **(SAND—84-0508C) Comet-II, a two-stage, magnetically switched pulsed-power module.** Neau, E.L.; Woolston, T.L.; Penn, K.J. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 4p. (CONF-8406137—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013063.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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Fast-switching saturable-core reactors, based on the use of Metglas amorphous metallic alloys, have been developed for use in a 370 kJ coaxial magnetic switching experiment, called Comet-II. Magnetic switches offer a low-loss mechanism for achieving multiterrawatt pulse compression, for super-power accelerators, coupled with the possibility of repetitive mode operation as would be required for an operational inertial confinement fusion application. Two separate series of experiments have been performed using two stages of magnetic pulse compression.

34955 **(SAND—84-0641C) Technical assessment of three thermal-hydraulic techniques for high heat flux fusion applications. Chapter IV.** Boyd, R.D.; Wong, C.P.C.; Cha, Y.S. (Sandia National Labs., Albuquerque, NM (USA); GA Technologies, Inc., San Diego, CA (USA); Argonne National Lab., IL (USA)). 1984. Contract AC04-76DP00789. 16p. (CONF-840816—9). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010143.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

This chapter is a technical assessment of three possible thermal-hydraulic, high heat flux removal techniques which will result in adequate heat removal with minimum penalty from components in fusion reactors. The heat removal alternatives discussed are: (1) subcooled flow boiling (SFB) with water, (2) high velocity helium gas convection, and (3) liquid metal heat transfer in the presence of a magnetic field. The assessment emphasizes advantages, disadvantages, available data base, and applicability of fusion component requirements.

34956 **(UCRL—15578) Primary heat transfer loop design for the Cascade inertial confinement fusion reactor.** Murray, K.A.; McDowell, M.W. (Rockwell International Corp., Golden, CO (USA). Energy Technology Engineering Center). May 1984. Contract W-7405-ENG-48. 17p. (SANL—322-006). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012687.

This study investigates a heat exchanger and balance of plant design to accompany the Cascade inertial confinement fusion reaction chamber concept. The concept uses solid Li_2O or other lithium-ceramic granules, held to the wall of a rotating reaction chamber by centrifugal action, as a tritium breeding blanket and first wall protection. The Li_2O granules enter the chamber at 800 K and exit at 1200 K after absorbing the thermal energy produced by the fusion process.

34957 **(UCRL—15600) Wide spectrum antireflective coating for laser fusion systems. Final report.** Yoldas, B.E; Partlow, D.P.; Smith, H.D.; Mattox, D.M. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 13 Jan 1984. Contract W-7405-ENG-48. 65p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013211.

A method of depositing a laser damage resistant, wide-spectrum antireflective coating on fused silica has been developed. This work was sponsored under a subcontract with the University of California, with technical direction from the Lawrence Livermore

National Laboratory. The coating is applied from a specific silanol polymer solution and converted to a porous SiO_2 film. The pore size of the film is first reduced by a heat treatment to prevent uv scattering. Then gradation of the pore volume is achieved by a mild etching to a sufficient depth to prevent a smoother index transition from air to the substrate glass. The resulting antireflectivity covers the entire transmission range of silica and may be extended to a wavelength as short as 250 nm. Laser damage thresholds as high as 9 j/cm² have been demonstrated on processed samples.

34958 **(UCRL—53541-83) Index of Laser Program publications and related reports, 1983.** (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 41p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013207.

This document provides a listing of titles and authors of publications from the LLNL Laser Program during calendar year 1983. It is presented as an aid for researchers in the field who may not otherwise have access to a full listing of laser-related work done at LLNL. The intent is to provide a brief and concise listing. Publications are classified by subject, but cross references are not supplied and those documents which logically fall in more than one category may not appear to be in the obvious location. We recognize that gaining access to the publications may be difficult, and have appended a listing of libraries that have microfiche copies of one or more years of LLNL Laser Program publications.

34959 **(UCRL—89546) Nova power systems: status and operating experience.** Whitham, K.; Merritt, B.T.; Gritton, D.G.; Smart, A.J.; Holloway, R.W.; Oicles, J.A. (Lawrence Livermore National Lab., CA (USA)). 28 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—162). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013070.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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This paper describes the pulse power systems that are used in these lasers; the status and the operating experiences. The pulsed power system for the Nova Laser is comprised of several distinct technology areas. The large capacitor banks for driving flashlamps that excite the laser glass is one area, the fast pulsers that drive pockels cell shutters is another area, and the contol system for the pulsed power is a third. This paper discusses the capacitor banks and control systems.

34960 **(UCRL—90200) LLNL nuclear data libraries used for fusion calculations.** Howerton, R.J. (Lawrence Livermore National Lab., CA (USA)). 21 May 1984. Contract W-7405-ENG-48. 17p. (CONF-840614—58). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84012955.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

The Physical Data Group of the Computational Physics Division of the Lawrence Livermore National Laboratory has as its principal responsibility the development and maintenance of those data that are related to nuclear reaction processes and are needed for Laboratory programs. Among these are the Magnetic Fusion Energy and the Inertial Confinement Fusion programs. To this end, we have developed and maintain a collection of data files or libraries. These include: files of experimental data of neutron induced reactions; an annotated bibliography of literature related to charged particle induced reactions with light nuclei; and four main libraries of evaluated data. We also maintain files of calculational constants developed from the evaluated libraries for use by Laboratory computer codes. The data used for fusion calculations are usually these calculational constants, but since they are derived by prescribed manipulation of evaluated data this discussion will describe the evaluated libraries.

34961 **Modular low aspect ratio-high beta torsatron.** Sheffield, G.V.; Furth, H.P. (to Dept. of Energy). US Patent 4,430,600. 7 Feb 1984. Filed date 1 Apr 1982. vp.

PAT-APPL-364276.

A fusion reactor device in which the toroidal magnetic field and at least a portion of the poloidal magnetic field are provided by a single set of modular coils. The coils are arranged on the surface of a low aspect ratio toroid in planes having the cylindrical coordinate relationship O=O /SUB i/ +kz where k is a constant equal to each coil's pitch and O /SUB i/ is the toroidal angle at which the i'th coil intersects the z=0 plane. The device may be described as a modular, high beta torsation whose screw symmetry is pointed along the systems major (z) axis. The toroid defined by the modular coils preferably has a racetrack minor cross section. When vertical field coils and preferably a toroidal plasma current are provided for magnetic field surface closure within the toroid, a vacuum magnetic field of racetrack shaped minor cross section with improved stability and beta valves is obtained.

34962 **Low density, microcellular foams, preparation, and articles.** Young, A.T.; Marsters, R.G.; Moreno, D.K. (to Dept. of Energy). US Patent 4,430,451. 7 Feb 1984. Filed date 3 Mar 1982. vp.

PAT-APPL-354553.

A microcellular low density foam of poly(4-methyl-1-pentene) which is particularly useful for forming targets for inertial confinement fusion has been developed. Articles made from the foam have been machined to tolerances of 0.0001 inch, although the densities of the fragile foam are low (about 10 to about 100mg/cc) and the cell sizes are small (about 10 to about 30 μm). Methods for forming the foam and articles are given; and the yield strength of the foam of the invention is higher than was obtained in other structures of this same material.

34963 **Design for a repetitive superconducting opening switch.** Gray, K.E.; Kampwirth, R.T. (Argonne National Lab., IL (USA)). *Cryogenics;* **24**: No. 1, 21-26(Jan 1984).

The paper details a design study of a superconducting opening switch suitable for discharging the stored energy of a superconducting inductor into a load at room temperature in a short time (approx. 1 μ s). In order to achieve a reasonable repetition rate of approx. 10 Hz, the superconducting element must be a thin film and consideration is given to the presently attainable properties of such films. The design is made specific to 10 000 V and 10 000 A.

34964 **Development of a facility for fatigue and fracture testing of stainless steels at liquid helium temperature.** Juhas, M.C.; Duncan, D.B.; Streit, R.D. (Lawrence Livermore National Lab., CA). *Cryogenics;* **23**: No. 11, 603-607(Nov 1983).

A facility for fracture toughness testing of stainless steel base metal and welds in liquid helium has been developed at Lawrence Livermore National Laboratory (LLNL) to qualify material selected for the mirror fusion programme. The purpose of the test facility is to perform fracture toughness tests (Jsub(Ic)) on candidate materials in an environment simulating the superconducting 'mirror' magnet. This paper discusses the design, development and implementation of the cryogenic test system as well as a brief interpretation of the data.

34965 **Inertial fusion with low energy heavy ions.** Maschke, A.W. (Accelerator Dept., Brookhaven Nat.'l Lab., Assoc. Univ.'s Inc., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3055-3056(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

High energy heavy ions have been under study for inertial fusion applications for some time. This paper explores the possibility of using heavy ions with energies less than 1 MeV as compared to the usual heavy ion fusion approach of using multi-GeV beams. The author's proposed approach is to produce such a lowenergy heavy ion beam in a spherically focused array using time-of-flight bunching and to achieve high power density at the target by accelerating a sufficiently bright beam to the required energies. The MEQALAC (Multipole Electrostatic Array Linear Accelerator) concept is mentioned as a suitable facility for these acceleration requirements. Various beam parameters and conditions are discussed, such as transverse temperature, current density, convergence density, profile, momentum transfer, ion source requirements, brightness and compression, which are necessary to the achievement of inertial fusion using a low-energy ion beam. Zeolites, thallium halides, xenon and hydrogen are mentioned as candidate ion source materi-

als. A feature of low energy heavy ion beams as compared with conventional heavy ion fusion is that the ion velocity is slow compared with either background plasma electron velocities or orbital electron velocities. The usefulness of these distinctions is stated and the need is stressed for more computerized simulation in order to uncover more completely the detail work required in low-energy heavy ion fusion.

34966 **An isochronous stacking ring approach to the HTE.** Selph, F.; Grunder, H.; Leemann, B. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3073-3075(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The problem of finding a suitable apparatus for demonstrating heavy ion fusion is a difficult one to approach in moderate steps. Ideally, such apparatus would be useful for testing beam transport, focusing and targeting concepts, and target behavior in the plasma regime, and the technology used in this "high temperature experiment" (HTE) would also be extended to construct a prototype fusion facility. A meaningful test of many of these concepts could be achieved with a device capable of heating a disk of material to plasma temperatures in the neighborhood of 100 eV or 1 million degrees K. Target heating for the HTE requires a short beam burst on the order of tens of nanoseconds with a total beam energy of a kilojoule or more. The RF linac falls far short of this capacity. A number of studies have looked at the use of storage rings for accumulating beam current. This paper looks at an alternative means: the use of a RF linac followed by an isochronous storage ring (ISR) producing rapidly the high multiplication of beam current required. This method avoids the necessity for beam manipulations such as splitting and bunching. Also, because of the fast transit time in the ISR, storage ring instabilities pose no problem. The paper discusses beam stacking with an isochronous ring and then addresses the use of an ISR for the HTE and the design and performance of an apparatus--consisting of an ion source, a RF linac, a stacking ring, and a number of beam lines to transfer beam bunches to the target--for such an application.

34967 **Stabilization of toroidal plasma devices.** Ohkawa, T. (to General Atomic Co., San Diego, CA (USA)). Australian Patent 80/54,555/B/. 23 Jun 1983. vp.

US PAT-APPL-007503.

The plasma device comprises a confinement vessel, means for producing plasma current within the vessel in the axial direction and first and second helical windings with the same sense of twist and at the same pitch. The first and second windings are disposed alternately and are equally spaced around the axis. A direct current is passed through the first windings and a second direct current through the second windings in the direction counter to the first current to generate a helical magnetic field acting in combination with the magnetic field produced by the plasma current. This produces a variation in a safety factor q with distance from the center of the plasma current in any direction transverse to the current. The polarity of q reverses near the boundary of the plasma current. Q is defined as the average over a flux surface of the number of transits of the length of the plasma current by a magnetic flux line in making a single transit around the plasma current. The absolute magnitude of q is less than 1 within the plasma current.

34968 **Conceptual design of a Moving-Ring Reactor.** Smith, A.C. Jr.; Ashworth, C.P.; Abreu, K.E. (Pacific Gas and Electric Co., San Francisco, CA (USA)). *Nuclear Fusion;* **2**: 447-458(1983). (CONF-820930—).

From 9. international conference on plasma physics and controlled nuclear fusion research (IAEA); Baltimore, MD, USA (1 Sep 1982).

A design of a prototype Moving-Ring Reactor has been completed. The fusion fuel is confined in current-carrying rings of magnetically field-reversed plasma ("compact toroids"). The plasma rings, formed by a coaxial plasma gun, undergo adiabatic magnetic compression to ignition temperature while they are being injected into the reactor's burner section. The cylindrical burner chamber is divided into three "burn stations". Separator coils and a slight axial guide-field gradient are used to shuttle the ignited toroids rapidly from one burn station to the next, pausing for one third of the total burn time at each station. D-T-^{3}He ice pellets refuel the rings at a rate which maintains constant radiated power. The first wall and tritium breeding blanket designs make credible use of helium cooling, SiC and Li_2O to minimize structural radioactivity. "Hands-on" maintenance is possible on all reactor components outside the blanket. The first wall and blanket are designed to shut the reactor down passively in the event of a loss-of-coolant or loss-of-flow accident. Helium removes heat from the first wall, blanket and shield, and is used in a closed-cycle gas turbine to produce electricity. Energy residing in the plasma ring at the end of the burn is recovered via magnetic expansion. Electrostatic direct conversion is not used in this design. The reactor produces a constant net power of 99 MW(e).

34969 **The development of high energy heavy ions for inertial confinement fusion. A phase approach.** Martin, R.L. (Argonne National Laboratory, Argonne, IL 60439). pp 43-54 of Energy storage, compression, and switching. Nardi, V.; Bostick, W.H.; Sahlin, H. New York, NY; Plenum Publishing Corp. (1983). (CONF-751247—).

From Colloquium on thermal insulators at high temperature; Paris, France (3 Dec 1975).

This chapter describes the Argonne National Laboratory's design of a minimal facility capable of both demonstrating all of the accelerator techniques required in a power plant size facility and also of performing several physics experiments of interest to heavy ion fusion. The proposed Phase I facility would make optimal use of existing facilities made available by the termination of operation of the Zero Gradient Synchrotron (ZGS), a 12 Ge V proton synchrotron for high energy physics, in 1979. Phase I would produce xenon beams of 6.4 Ge V containing up to 10kJ of beam energy at 4 TW suitable for focusing onto foils for energy deposition experiments and studies of various beam-plasma instability experiments.

34970 **(ORNL-tr—5130) Electromagnetic theory of an antenna for ICR heating of a plasma in tokamaks.** Vdovin, V.L.; Kurchatov, I.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. Contract AC05-84OR21400. C; IAE-3728/8. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012988.

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The present paper develops the electomagnetic theory of an antenna for ICR heating of a plasma in tokamaks. The basic numerical calculations for the INTOR reactor are given. The dependences of antenna impedance on its geometry and the plasma parameters were obtained. The substantial portion of the power transfered by the unretarded waves was discovered. This distortion of the spectrum is apparently substantial also with lower-hybrid heating if a grill is introduced into the tokamak chamber in a special extension of the connecting piece or is projected toward the plasma beyond the first wall of the tokamak. Measures for eliminating these slightly retarded waves are evaluated (the effects of the influence of short radial conductors are considered suppressed by the antiphase feeding of the adjacent feeders. The theory that was developed facilities calculating the antenna for the ion-cyclotron heating of the plasma of large-scale tokamaks.

99 GENERAL AND MISCELLANEOUS

34971 **(MLM—3150) Mound activities in chemical and physical research: July-December 1983.** (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 15 Jun 1984. Contract AC04-76DP00053. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013629.

The following are reported: calculation of properties of ortho and para hydrogen; helium-4 second virials applied to gas thermometry; reaction rates in $D_2 + T_2$ mixtures; liquid phase thermal diffusion; zinc isotope separation; and removal of ruthenium from aqueous solution using freshly precipitated metals as scavengers.

34972 (ORNL/PPA—84/2) Summary report on responses to a questionnaire on DOE's materials research facilities. Modine, F.A. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013549.

A survey was carried out by DOE staff of the following DOE facilities: HFIR, IPNS, RTNS, FMIT, FFTF, NCEM, HVEM, SSRL, NSLS, NCAM, and HTML. The survey questions covered the rationale of each facility, the cost, plans for expansion or termination, capabilities, and accomplishments. (DLC)

9901 Management

REFER ALSO TO CITATION(S) 33429, 35006, 35007

34973 (ANL/TM—418) Specifications for the PBX-based digital telecommunications system. Amiot, L.W.; Davison, G.W.; Winter, A.N. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 97p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013915.

This technical memorandum contains the requirements of Argonne National Laboratory for a PBX-based digital telecommunications system, DTS. The Technical Specification was incorporated as part of the solicitations for proposals for a new DTS which was sent to prospective vendors on June 15, 1984. Argonne National Laboratory has issued a Request for Proposals for the acquisition and installation of a PBX-Based Digital Telecommunications System (DTS). The system will serve Argonne National Laboratory and the Department of Energy at the Argonne, Illinois, site, where it will replace the present Centrex telephone service that Illinois Bell Telephone Company now provides. The new system will provide cost-effective telephone service and will greatly improve voice and data communications. Argonne is asking potential vendors to propose the replacement of the current telephone system, as well as the installation of an entirely new inside and outside wire and cable plant. The combination of the two will allow a substantial increase in the quality and control of voice and data communications at the Laboratory.

34974 (DOE/ER—0179) Guide to energy R and D programs for universities and other research groups. (USDOE Office of Energy Research, Washington, DC). Jun 1984. 89p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84013079.

The purpose of this guide to provide researchers in universities and other research institutions with summary-level information on the various research and development programs supported by the Department. Collectively, DOE programs support a wide range of research activities - from studies on the fundamental nature of matter and energy to exploratory and advanced research on the development of new technical approaches leading to new energy technologies. The guide summarizes, in one source, basic information on DOE's energy research and development and related programs, interests and needs. It supplies information on current Federal and DOE grant and contract policies and procedures and lists the names of DOE staff, by program area, from whom additional information may be obtained.

34975 (DOE/EV/10662—T1) US Department of Energy (DOE) Guidelines for the development of metrication program plans. (Sterling Systems, Inc., Rockville, MD (USA)). 1984. Contract AC01-81EV10662. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013275.

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The objective of these Guidelines is to assist Departmental elements in pursuing an orderly and coordinated transition to the use of the metric system in all activities in a manner consistent with DOE policy. These Guidelines provide the means for a systematic and efficient approach to the planning process, taking into consideration economic, technical, quality, health and safety, and long-range planning factors when addressing each conversion action. These Guidelines will assist Departmental elements in developing a metrication program plan in their areas of responsibility. The scope and format of these individual metrication program plans shall conform to these Guidelines. Upon completion, these metrication program plans will be submitted by the heads of Headquarters elements and Field organizations, and the Chairman of the Federal Energy Regulatory Commission to the Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness (ASEP). The ASEP will review and incorporate these metrication program plans into the Department's overall metrication program plan.

34976 (DOE/MA—0155) Cost and Schedule Control Systems Criteria for contract performance measurement. Information pamphlet. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). May 1984. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84012576.

The purpose of this pamphlet is to inform interested DOE and industry personnel about the basic concepts and general requirements of the Cost and Schedule Control Systems Criteria (CSCSC) of DOE Order 2250.1A. the CSCSC do not represent a management system nor do they prescribe specific methods of organization or operation. The criteria are intended to serve as standards of measuring adequacy of management control systems. Objectives in using the criteria are: (1) to provide an accurate status of contract progress; (2) to provide early visibility to problems - prevent surprises; (3) to improve estimated final cost projections; (4) to improve on shortcomings of prior requirements; and (5) to minimize proliferation of systems and data problems. The CSCSC contain thirty-five criteria which are grouped into five categories: organization; planning and budgeting; accounting; analysis; and revisions and access to data.

34977 (DOE/NBB—0024/1) Report on 1984 national survey of compensation paid scientists and engineers engaged in research and development activities. (Battelle Columbus Labs., OH (USA)). Jun 1984. Contract W-7405-ENG-92. 355p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84013105.

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In November 1966, the United States Department of Energy awarded a contract to the Columbus Laboratories of Battelle to design a survey of compensation paid to scientific and engineering personnel engaged in research and development in the United States. The contract provided that such a survey would utilize the maturity of age-wage approach, under which salary data would be related to years since receipt of degree or chronological age. This document reports the results of the sixteenth annual survey, conducted in 1984.

34978 (ORNL/TM—9136) Conceptual design: Subtask 1.B of the Major Item System Mapping project. Bengtson, P.Y.; Hadder, G.R.; Stevens, M.M.; Loffman, R.S.; Holcomb, B.D.; Thomas, B.; Zuschneid, P.B.; Guy, M.S. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013623.

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This Conceptual Design document, which reflects the completion of the systems design stage, is a requirement of an Oak Ridge National Laboratory project to develop a Major Item System Mapping (MISM) software system. This document will be followed in implementing the project for data collection, programming, documentation, and user training. The purpose of the MISM project is to collect a variety of data on items of equipment managed by the Army and to map the items into systems. This information will be used for a variety of budgeting and managing purposes. The mapping of items into systems is necessary because funding and analyses are based on an equipment system concept.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 32756, 32757, 33852, 33854, 34646, 34786

34979 (CONF-8403128—1) Role of personal desktop computers in the Argonne integrated heterogeneous file transfer network. Schofield, J. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02; 3; GPO Dep. Order Number DE84010508.

From Association for Computing Machinery North Central Region conference on making the micro to mainframe connection; Chicago, IL, USA (23 Mar 1984).

Paper copy only, copy does not permit microfiche production.

This presentation described the computing environment at Argonne National Laboratory and the actions underway to integrate personal desktop computers into a coherent hierarchy of computing systems connected through a heterogeneous file transfer network. We regard the arrival of personal desktop computers as both inevitable and benign, and we are pursuing policies to ensure that they are compatible with and complementary to the rest of the Laboratory's computer resources.

34980 (DOE/RA/50420—1) Frequency response design methods for large scale systems. (Maryland Univ., College Park (USA)). May 1984. Contract AC01-80RA50420. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013111.

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The basic idea behind this project was to extend the existing techniques for the design of multivariable control systems in two ways. For linear systems, where the computer aided design of multivariable control systems is relatively well established, the emphasis was on techniques to extend these methods so they could be applied to the decentralized control of large scale systems. For nonlinear systems, where the design of control systems is still very poorly understood, the emphasis has been on both specially structured large nonlinear systems where design results can be obtained and on extensions of techniques from the design of controllers for linear systems. A design method was produced that extends all of the techniques for computer aided design of linear multivariable control systems to large scale systems. Lie algebraic methods were used to develop observers and canonical forms for classes of nonlinear systems. Procedures were also developed for avoiding transmission zeroes of multivariable plants by means of modulating the controller signals. All of these results, and others, are briefly described in this report. 42 references.

34981 (LA—9917-MS) Numerical methods for tracking interfaces. Hyman, J.M. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013852.

An overview is given of special numerical methods for tracking discontinuous fronts and interfaces. These methods include surface tracking methods based on connected marker points along the interface, volume tracking methods that track the volume occupied by the solution regions bounded by the interfaces, and moving-mesh methods where the underlying mesh is aligned and moved with the interface. The pros and cons of the current methods are discussed, and a new method is proposed that overcomes some of the difficulties encountered in approximating equations with multiple interacting interfaces. 29 references, 7 figures.

34982 (LA—10005) MECA: a supercomputer for Monte Carlo. Solem, J.C. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014129.

I compare discrete-ordinates and Monte Carlo techniques for solving integrodifferential equations and compare their relative adaptability to vector processors. I discuss the utility of multiprocessors for Monte Carlo calculations and describe a simple architecture (the monodirectional edge-coupled array of MECA) that seems ideally suited to Monte Carlo and overcomes many of the packaging problems associated with more general multiprocessors.

34983 (LA-UR—84-1499) Investigation of an empirical probability measure based test for multivariate normality. Booker, J.M.; Johnson, M.E.; Beckman, R.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 33p. (CONF-840849—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012626.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

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Foutz (1980) derived a goodness of fit test for a hypothesis specifying a continuous, p-variate distribution. The test statistic is both distribution-free and independent of p. In adapting the Foutz test for multivariate normality, we consider using chi^2 and rescaled beta variates in constructing statistically equivalent blocks. The Foutz test is compared to other multivariate normality tests developed by Hawkins (1981) and Malkovich and Afifi (1973). The set of alternative distributions tested include Pearson type II and type VII, Johnson translations, Plackett, and distributions arising from Khintchine's theorem. Univariate alternatives from the general class developed by Johnson et al. (1980) were also used. An empirical study confirms the independence of the test statistic on p even when parameters are estimated. In general, the Foutz test is less conservative under the null hypothesis but has poorer power under most alternatives than the other tests.

34984 (LA-UR—84-1561) Effect of queueing disciplines on response times in distributed systems. Williams, E. (Texas Univ., Austin (USA). Dept. of Computer Sciences). 1984. Contract W-7405-ENG-36. 4p. (CONF-840869—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012639.

From International conference on parallel processing; Bellaire, MI, USA (21 Aug 1984).

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A distributed program consists of processes, many of which can execute concurrently on different processors in a distributed system of processors. When several processes from the same or different distributed programs have been assigned to a processor in a distributed system, the processor must select the next process to run. The question investigated is: What is an appropriate method for selecting the next process to run. Standard processor queueing disciplines, such as first-come-first-serve and round-robin-fixed-quantum, are studied. The results for four classes of queueing disciplines tested on three problems are presented. These problems were run on a testbed, consisting of a compiler and simulator used to run distributed programs on user-specified architectures.

34985 (LA-UR—84-1583) Monte Carlo estimation under different distributions using the same simulation. Beckman, R.J.; McKay, M.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 24p. (CONF-840849—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012438.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

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Two methods for reducing the computer time necessary to investigate changes in distribution of random inputs of large simulation computer codes are presented. The first method produces unbiased estimators of functions of the output variable under the new distribution of the inputs. The second method generates a subset of the original outputs which has a distribution corresponding to the new distribution of inputs. Efficiencies of the two methods are examined.

34986 (LA-UR—84-1676) Linear algebra programs for use on a vector computer with a secondary solid state storage device. Bucher, I.Y.; Jordan, T.L. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8406113—4). NTIS, PC A02; 3; GPO Dep. Order Number DE84012445.

From 5. IMACS international symposium; Bethlehem, PA, USA (19 Jun 1984).

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A portable set of linear algebra subprograms for use on a vector computer with an attached fast secondary storage device has been developed. The set currently contains routines for matrix multiplication and for the solution of block tridiagonal, symmetric and positive definite, and general systems of linear equations. Main matrices are stored on the external device in blocked form, and block matrix techniques are used throughout. Performance data are presented which demonstrate that the speed of the routines approaches that of routines with all data in main memory and is close to the maximum speed of the processor.

34987 **(LALP—82-9(6/82)) Center for computer security: Computer Security Group conference. Summary.** (Los Alamos National Lab., NM (USA)). Jun 1982. Contract W-7405-ENG-36. 41p. (CONF-820297—Summ.). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012992.

From 4. DOE computer security group conference; Albuquerque, NM, USA (9 Feb 1982).

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Topics covered include: computer security management; detection and prevention of computer misuse; certification and accreditation; protection of computer security, perspective from a program office; risk analysis; secure accreditation systems; data base security; implementing R & D; key notarization system; DOD computer security center; the Sandia experience; inspector general's report; and backup and contingency planning. (GHT)

34988 **(LALP—83-9(5-83)) Center for Computer Security newsletter. Volume 2, Number 3.** (Los Alamos National Lab., NM (USA)). May 1983. Contract W-7405-ENG-36. 56p. (CONF-821126—Summ.). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84011736.

From 5. DOE computer security conference; Knoxville, TN, USA (16 Nov 1982).

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The Fifth Computer Security Group Conference was held November 16 to 18, 1982, at the Knoxville Hilton in Knoxville, Tennessee. Attending were 183 people, representing the Department of Energy, DOE contractors, other government agencies, and vendor organizations. In these papers are abridgements of most of the papers presented in Knoxville. Less than half-a-dozen speakers failed to furnish either abstracts or full-text papers of their Knoxville presentations.

34989 **(LALP—84-13(3-84)) Center for Computer Security newsletter. Volume 3, Number 3.** (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 68p. (CONF-830765—Summs.). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84011742.

From 6. computer security conference; Denver, CO, USA (25 Jul 1983).

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Topics covered at the conference include: OPMODEL - the security aspects of Phase II; security of distributed ADP systems, problems and some solutions; acquiring a commercial turnkey local area network; networking at Lawrence Livermore National Laboratory; risk analysis, a realistic automated tool; decision analytic methods for security and safeguards risk assessment; Sandia National Laboratories Albuquerque Security Testing; using the Trusted Computer System Evaluation Criteria; DOE applications of the Trusted Computer System Evaluation Criteria; authentication, discretionary and nondiscretionary access control in computer networks; Link ACE, a data link access control and encryption system; ADP security education at Bendix Kansas City; computer assisted instruction and its role in the DOE headquarters computer protection program; the impact of security controls on computing productivity; Colorado and computer crime law, potential applications; and General Accounting Office views on management of microcomputers. (GHT)

34990 **(LALP—84-14) Engineering sciences research highlights. Fiscal year 1983.** Tucker, E.F.; Dobratz, B. (comp.). (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014135.

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The Laboratory's overall mission is sixfold. We are charged with developing nuclear warheads for defense, technology for arms control, and new concepts for defense against nuclear attack; with supporting programs for both nonnuclear defense and energy research and development; and with advancing our knowledge of science and technology so that we can respond to other national needs. Major programs in support of this mission involve nuclear weapons, energy, environmental science, and basic research. Specific areas of investigation include the design, development, and testing of nuclear weapons; nuclear safeguards and security; inertial and magnetic fusion and nuclear, solar, fossil, and geothermal energy; and basic research in physics, chemistry, mathematics, engineering, and the computer and life sciences. With the staff and facilities maintained for these and other programs, the Laboratory can respond to specific national needs in virtually all areas of the physical and life sciences. Within the Laboratory's organization, most technical research activities are carried out in three directorates: Engineering Sciences; Physics and Mathematics; and Chemistry, Earth and Life Sciences. The activities highlighted here are examples of unclassified work carried out in the seven divisions that made up the Engineering Sciences Directorate at the end of fiscal year 1983. Brief descriptions of these divisions' goals and capabilities and summaries of selected projects illustrate the diversity of talent, expertise, and facilities maintained within the Engineering Sciences Directorate.

34991 **(LBL—17709) Raw QIO interface to Eunice TCP circuits.** Sventek, J.S. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013880.

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This document describes the raw QIO interface to TCP circuits provided by the Eunice TCP/IP networking code. Example sections of code (in FORTRAN) are also provided to aid others writing network applications.

34992 **(NUREG/CR—3686-Vol.1) WIPS: computer code for Whip and Impact Analysis of Piping Systems. Summary report and Part A: User's manual. Volume 1.** Powell, G.H.; Hollings, J.P.; Row, D.G.; Chen, P.; Hu, F.C.; Mahasuverachai, M.; Mosaddad, B.; Nicklin, P.; Nour-Omid, S.; Oughourlian, C.; Riahi, A. (California Univ., Berkeley (USA). Dept. of Civil Engineering). Mar 1983. Contract W-7405-ENG-48. 273p. (UCRL—15597-Summ.andVol.1). NTIS, PC A12/MF A01; 1 - GPO; GPO Dep. Order Number DE84007415.

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WIPS consists of a series of sixteen computational modules, executed under the control of the WIPS-EXEC executive program. Twelve of the modules are used for specification of piping system properties and analysis control information. These modules constitute the WIPS-INPT package. They are executed interactively, in an appropriate sequence, in order to produce an input data file for the WIPS-ANAL structural analysis module. WIPS-ANAL is typically executed in batch mode, and produces certain output files. The remaining three modules can then be executed interactively to produce tabular and graphical results from the WIPS-ANAL output. Sections A1 through A10 of this manual present instructions and examples on the use of the WIPS modules. In addition, it is possible to prepare an input data file for WIPS-ANAL without using the WIPS-INPT package, and to run WIPS-ANAL as a stand-alone code. Instructions for direct preparation of WIPS-ANAL input data are presented in Section A11.

34993 **(NUREG/CR—3686-Vol.2) WIPS - computer code for whip and impact analysis of piping systems. Part B. Theory manual. Vol. 2.** Powell, G.H.; Hollings, J.P.; Row, D.G.; Chen, P.; Hu, F.C.; Mahasuverachai, M.; Mosaddad, B.; Nicklin, P.; Nour-Omid, S.; Oughourlian, C. (California Univ., Berkeley (USA)). Mar 1983. Contract W-7405-ENG-48. 204p. (UCRL—15597-Vol.2). NTIS, PC A10/MF A01; GPO Dep. Order Number DE84007416.

WIPS-ANAL is the structural analysis module of the WIPS code. WIPS-ANAL incorporates a sophisticated solution strategy

for nonlinear dynamic analysis, and currently has a library of five structural elements (PIPE, BEAM, UBAR, SHELL, and GAPF). This manual describes the solution strategy, and presents the assumptions and theory for each of the structural elements. Two of the sections (B2 on material theory and B5 on large displacements theory) present theoretical material which is common to two or more elements. A typical WIPS user will generally not be concerned with the theoretical details of the elements. Nevertheless, a basic understanding of the assumptions and procedures is desirable. A sufficient understanding for most applications can be obtained by studying the first one or two chapters for each element type.

34994 **(PNL-SA—12161) Basic geometric algorithms for use with graphic input.** Littlefield, R.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 11p. (CONF-8405194—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013256.

From 5. annual conference and exposition of the National Computer Graphics Association; Anaheim, CA, USA (13 May 1984).

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When a user positions the cursor on the screen of a graphics terminal, it is usually easy for a program to obtain the coordinates. Translating those into useful action is harder. Often, the program must find the data point or line nearest to the cursor, or determine whether a point is inside some polygon. These geometric relationships seem simple, but algorithms for evaluating them often are not obvious. This paper presents a collection of useful techniques, and discusses how they can be used to graphically control functions like identifying points, picking subsets, and zooming a plot.

34995 **(SAND—83-2496C) Solving low density knapsacks.** Brickell, E.F. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 14p. (CONF-840830—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006964.

From Crypto '83 conference; Santa Barbara, CA, USA (22 Aug 1984).

In this paper, we describe two methods for solving knapsacks of low density. Method 1 is a technique for solving knapsack problems that appears to work for almost all knapsacks of density less than $1/\log_2 n$. Method 2 is a slightly different technique that works on almost all knapsacks of density less than d(n), where d(n) is a function of n that is significantly larger than $1/\log_2 n$. However, our estimates of d(n) come from empirical studies.

34996 **(SAND—84-0479C) Asymptotic relative efficiencies of the rank transformation procedure in randomized complete block designs.** Hora, S.C.; Iman, R.L. (Texas Tech Univ., Lubbock (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 24p. (CONF-840849—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010600.

From Annual meeting of the American Statistical Association (ASA); Philadelphia, PA, USA (12 Aug 1984).

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Rank tests provide an alternative to the usual normal theory F-test for the analysis of data from randomized complete blocks experiments. Two such rank tests are the Friedman test which employs the method of n-rankings and the rank transformation procedure which employs an overall ranking of the data. In this paper the asymptotic efficiency of the rank transformation procedure is developed and compared to the asymptotic efficiencies of Friedman's test and the usual F-test. These efficiencies are developed using contiguous alternatives that are shifts in location. Comparisons among the three tests are made using normal, Student, and double exponential within block distributions. Block effects are introduced by drawing location shifts from normal and uniform distributions and, also, by drawing scale changes from an inverted gamma densities. The asymptotic relative efficiencies were evaluated using numerical procedures.

34997 **(SOL—84-3) Duality in inexact fractional programming with set-inclusive constraints.** Kaul, R.N.; Kaur, S.; Lyall, V. (Stanford Univ., CA (USA). Systems Optimization Lab.). Jun 1984. Contract AT03-76ER72018. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013584.

This paper extends the fractional programming problem with set-inclusive constraints studied earlier by replacing every coefficient vector in the objective function with a convex set. A dual is formulated and well known duality results are established. A numerical example illustrates the dual strategy to obtain the value of the initial problem.

34998 **(UCRL—15586) Hierarchical log design for large-scale systems. Final report.** Hodzic, M.; Siljak, D.D. (LSS Consulting, Saratoga, CA (USA)). 27 Jan 1984. Contract W-7405-ENG-48. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013072.

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The objective of this report is to present a piece-by-piece LQG design for large-scale systems. The proposed design procedure is developed for a hierarchical (block-triangular) representation of the system, which is obtained via a graph-theoretic decomposition algorithm. The estimator is built as a union of low-order optimal estimators attached to each individual subsystem sequentially going from the top to the bottom of the hierarchy. As the subsystem state estimates become available, optimal controllers can be designed for each subsystem separately resulting in an overall closed-loop system which is stable and suboptimal. This design process offers a considerable reduction of both off-line and on-line computations, which is especially effective in large sparse systems.

34999 **(UCRL—15606) Operating system and memory switch for the S-1 computer.** Rubin, J.; Panofsky, T.; Frost, M.; LeBrun, M. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013094.

During this period the Stanford Artificial Intelligence Laboratory worked on many aspects of the S-1 project. These included: (1) the first architectural manual and various features of the architecture, (2) simulator for PDP-10 on S-1, simulator for YUK-7 on S-1, (3) design and debugging of Pascal compilers and intermediate languages on the S-1, and (4) memory switch for S-1.

35000 **(UCRL—15607) S-1 software development and maintenance. Final report, October 1, 1981-September 30, 1982.** Wiederhold, G.C.M. (Stanford Univ., CA (USA). Dept. of Computer Science). 29 Sep 1983. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013071.

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Under the 11th amendment to contract LLL PO No. 9083403 we have continued the development and maintenance of FORTRAN language facilities and related projects for the LLNL S-1 Multiprocessor System. This system is being implemented within the Physics Special Studies Program at the Lawrence Livermore National Laboratory and represents potentially one of the most powerful computer complexes available. This is the final report covering this contract, earlier reports have been delivered to the Lawrenc Livermore National laboratory as previous funding periods came to a close. A suite of significant software products have been developed under this contract, the technical section of this report will elaborate on the recent achievements. We have also provided computer services to students and staff associated with the project, who were located both at Stanford University and at the Livermore itself. Eventually Livermore brought its own system into operation, so that the level of these services could diminish.

35001 **(UCRL—19392-Rev.1) TAURUS: an interactive post-processor for the analysis codes NIKE3D, DYNA3D, TACO3D, and GEMINI. Revision 1.** Brown, B.E.; Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013863.

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This report provides a user's manual for the post-processor, TAURUS. TAURUS reads the binary plot files generated by the two and three dimensional finite element codes currently used at LLNL and plots contours, time histories, and deformed shapes. Contours of a large number of quantities may be plotted on meshes consisting of plate, shell, and solid type elements. TAURUS can compute a variety of strain measures, reaction forces along constrained boundaries, and momentum. TAURUS is operational on the CRAY-1, 7600, and VAX computers.

35002 **(UCRL—53548) Graphs in sound: a numerical data analysis method for the blind.** Mansur, D.L. (Lawrence Livermore National Lab., CA (USA)). 15 Jun 1984. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013322.

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In this study computer-generated sound patterns were shown to provide the blind with the ability to analyze 2-dimensional graphical data. A continuously-varying pitch was used to represent the amplitude of a curve in the y-direction, and time was used to represent motion in the x-direction. Human factors experiments were performed on 14 subjects to compare the tactile-graph methods normally used by the blind, to these new sound-graphs. It was discovered that mathematical concepts such as symmetry, monotonicity and the slopes of lines could be determined more quickly using sound. The relative accuracy of the subjects on five sets of test questions was virtually the same (sound = 84.6%, tactile = 88.9%, p = 0.05), and even better performance could be expected with greater training. The flexibility, speed, cost effectiveness and greater measure of independence provided the blind or sight-impaired using these sound methods was demonstrated. 23 references, 4 figures, 2 tables.

35003 **(UCRL—89165) S-1 Mark IIA supercomputer.** Farmwald, P.M. (Lawrence Livermore National Lab., CA (USA)). 20 Jun 1983. Contract W-7405-ENG-48. 12p. (CONF-830685—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012374.

From NATO Advanced Research Institute workshop on high speed computation; Juelich, F.R. Germany (20 Jun 1983).

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This paper describes the S-1 Mark IIA Multiprocessor System. It is composed of up to 16 supercomputer class uniprocessors with multiple local caches, an extremely large, medium-latency high-bandwidth shared memory, and a low-latency synchronization mechanism for passing short messages. The system is applicable to a wide variety of applications, including large-scale physical simulation, real-time command and control and program development in a time-sharing environment. The hardware organization, its implications, and software supporting the efficient utilization of the multiprocessor are discussed.

35004 **Determination of the polarization resistance with AC impedance measurements.** Mansfeld, F.; Lorenz, W.J. (Rockwell International Science Center, Thousand Oaks, CA). *Proceedings - Electrochemical Society;* **81-82**: 333-335(1981). (CONF-811013—Vol.81-82-Absts).

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

9903 Information Handling

35005 **(DOE/OR/21400—T21) Project plan to enhance the accessibility and availability of the LIF for the LCA (PAAL).** Loebl, A.S.; Barnes, R.W.; Stevens, S.S. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84012348.

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The US Army Logistics Control Activity (LCA) maintains a data base containing information on the worldwide supply and distribution flows of Army materials. This data base exists to provide information both for management of the logistics system and to help the users track their requisitioned material as it moves through the pipeline. The data base has grown very large, currently encompassing more than 30 million records in more than 30 different individual data sets. These records are kept on magnetic disk storage units for access and processing. The primary record is a representation of the individual requisition for material, augmented by shipping information as first the requisition and then the material proceeds through the actual logistics system. Collectively, this information is known as the Logistics Intelligence File (LIF). In this document, we present our perception of the demand for information products from the LIF and the developmental activities needed to meet those demands. We also provide preliminary schedules for tasks and activities associated with this plan. For those tasks which have already been initiated, we give a summary of our progress to date. Finally, we present our estimates of the cost and resources required to implement this plan, together with an estimate of the special assistance needed from LCA.

35006 **(ORNL/TM—8621) ORNL ALPHA MIS user's manual.** Lovin, J.K.; Haese, R.L.; Lambdin, H.D.; Bowen, P.L. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013771.

ALPHA is the most powerful and versatile of the Management Information Systems (MISs) sponsored and developed by the Finance and Materials Division of the Oak Ridge National Laboratory (ORNL). A general-purpose MIS, ALPHA can perform at least 75% of the common tasks required of MISs; it allows users to access any System 1022 data base on ORNL's PDP-10 computer to obtain information for use in the management process. This user's manual contains a description of the function of each ALPHA command and option. Besides the explanation of ALPHA's commands and options, this manual also contains a description of the ALPHA system, pointers on using ALPHA, an explanation of ALPHA's design in terms of its working vocabulary, and a sample problem.

35007 **(ORNL/TM—9232) Evaluation of the System 2000 data base management system for use in major item system mapping.** Duncan, L.D.; Taylor, B.S.; Tomlinson, J.P. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013130.

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This document reports the results of a study performed by Oak Ridge National Laboratory (ORNL) for the US Army Material Development and Readiness Command (DARCOM) under an Interagency Agreement, Department of Energy (DOE) No. 40-1307-82. The purpose of the study was to compare the short- and long-term requirements of the Major Item System Mapping (MISM) computer software system with the capabilities of the System 2000 data base management system. MISM is intended to provide a system oriented approach for budgeting and managing major items of equipment. Both the hardware resource requirements and software features of System 2000 were evaluated.

35008 **(UCRL—90276) Online directory of databases for material properties.** Hampel, V.E.; Bollinger, W.A.; Gaynor, C.A.; Oldani, J.J. (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 122p. (CONF-8406139—1). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013210.

From 9. international CODATA conference; Jerusalem, Israel (24 Jun 1984).

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We have created an online directory of databases of material properties on the Technology Information System at Lawrence Livermore National Laboratory (LLNL/TIS). This directory is intended to provide interactive access to scientific and technical databases available to the public that contain information pertaining to nuclear, atomic, molecular, physical, chemical, and mechanical properties of substances. The directory is based on work done earlier by Joseph Hilsenrath of the National Bureau of Standards (NBS/OSRD) and Jack H. Westbrook of General Electric Corporation. In addition to the 101 data files previously reported, we have up-

dated the information and identified more than 38 new numeric databases and predictive systems in these fields. We have included, where applicable, entries contained in the directories published by Cuadra Associates, CODATA, and UNESCO. In addition to describing the contents of the databases, we have provided updated information on the availability of the databases and their online access over public telephone and data networks. The online directory is prepared for use by scientists and engineers and should enhance the sharing of S & T resources over communication networks. This directory is expected to become particularly important to the national and international magnetic- and laser-energy fusion projects, nuclear criticality safety, and computer aided engineering programs. Some of the numeric databases are directly accessible by authorized users via the TIS Intelligent Gateway Processor at LLNL (TIS/IGP), with self-guiding procedures for the downloading, merging, post-processing, and graphical/statistical analysis of data.

9905 Civilian Defense

35009 (OEVS-Mitteilung—1/83, pp 65-79) **Recommendations for radiation shelters.** Karacson, P. (Amt der Niederoesterreichischen Landesregierung, Vienna (Austria)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780298. (CONF-8206244—).

From Annual meeting of the Austrian Association for Radiation Protection on protection of the population against radiation of nuclear weapons; Vienna, Austria (29 Jun 1982).

Among other things shelters are meant to offer a sufficient protection against radiation after explosions of nuclear weapons. The precautions and measures that are necessary for this purpose are described. (Author).

35010 (OEVS-Mitteilung—1/83, pp 81-84) **Radiation shelters in Austria.** Schultz, R. (Bundesministerium fuer Bauten und Technik, Vienna (Austria)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780298. (CONF-8206244—).

From Annual meeting of the Austrian Association for Radiation Protection on protection of the population against radiation of nuclear weapons; Vienna, Austria (29 Jun 1982).

Although building shelters in Austria has been advanced in the last few years there are still to be induced several studies. Ways to supply the Austrian population with shelters are discussed. (Author).

35011 (OEVS-Mitteilung—1/83, pp 85-95) **Alarm organization for the case of increased radioactivity in Switzerland.** Jeschki, W. (Hauptabteilung fuer die Sicherheit von Kernanlagen, Wuerenlingen (Switzerland)). 1983. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI84780298. (CONF-8206244—).

From Annual meeting of the Austrian Association for Radiation Protection on protection of the population against radiation of nuclear weapons; Vienna, Austria (29 Jun 1982).

Provision has been made for occurrence of dangerously increased radioactivity within Switzerland, irrespective of its origin, military or civilian. Organizations created to recognize, measure evaluate the radioactive danger to decide on and implement protective measures to inform the population etc. are described. Finally the communication and alarm devices, shelters, measuring instruments etc. at the disposal of the alarming organization are given in detail. (G.Q.).

35012 (UCRL—15605) **Do-It-Yourself fallout/blast shelter evaluation.** Nash, P.T.; Baker, W.E.; Esparza, E.D.; Westine, P.S.; Blaylock, N.W. Jr. (Southwest Research Inst., San Antonio, TX (USA)). Mar 1984. Contract W-7405-ENG-48. 172p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013220.

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Expedient fallout shelters recommended to the general public were evaluated for their potential to provide safety to occupants during nuclear blast. The blast threat was in the 2 to 50 psi overpressure range from a 1 megaton (MT) yield weapon. Research included a literature search for expedient shelter designs and evaluations of the designs to certify their ability to protect occupants. Shelters were evaluated systematically by first analyzing each design for expected failure loads. Next, scale model tests were planned and conducted in the Fort Cronkhite shock tunnel. Structural responses and blast pressures were recorded in a series of twelve experiments involving 96 structural response models. Two rigid models were included in each test to measure internal blast pressure leakage. Probabilities of survival were determined for each of the shelters tested. 47 references, 71 figures, 24 tables.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Advanced Fuel Research, Inc., East Hartford, CT (USA)
Investigation of vaporization and devolatilization of coal/water mixtures. Seventh quarterly report, November 1, 1983-January 31, 1984, 9:32622 (R;US)

Advanced Mechanical Technology, Inc., Newton, MA (USA)
High-efficiency commercial water heater development. Annual report Jan-Dec 83, 9:33567 (R;US)

AIA Foundation, Washington, DC (USA)
Future for residential photovoltaic systems, 9:32909 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
Electric vehicle modeling and simulation. Technical report, 9:33597 (R;US)

Air Pollution Control Directorate (Canada)
Proceedings: environmental government affairs seminar, 9:33436 (R;CA)

Air Pollution Technology, Inc., San Diego, CA (USA)
Fundamental study of sulfate aerosol formation, condensation, and growth. Final report Oct 80-Sep 82, 9:34242 (R;US)

Air Products and Chemicals, Inc., Allentown, PA (USA)
Corrosion of fractionation towers in coal liquefaction plants, 9:32504 (R;US)
Liquid Phase Methanol Process Development Unit: installation, operation, and support studies. Technical progress report No. 10, 1 January-31 March 1984, 9:32794 (R;US)
Liquid product characterization and compatibility studies. Final technical report, 9:32507 (R;US)
Study of the kinetics of hydrogenation using aged catalysts. Quarterly technical progress report, 1 October 1983-31 December 1983, 9:32522 (R;US)

Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center
Board discharge limiting device and bad module detector for electric vehicles. Final report, 9:33601 (R;US)
Evaluation of a 96v globe ev 1000 battery pact at temperature extremes. Final report, 9:33382 (R;US)
Evaluation of an 96v ALCO 2200 battery pack at temperature extremes. Final report, 9:33383 (R;US)
Evaluation of an 96v Exide XPV23-3 battery pack at temperature extremes. Final report, 9:33384 (R;US)

Alberta Univ., Edmonton (Canada)
Anomalous surface impedance in reentrant ferromagnetic superconductors, 9:33710 (R;US)

Allis-Chalmers Energy and Minerals Systems Co., Oak Creek, WI (USA). Process Research and Test Center
Compaction and granulation of coal liquefaction residue. Final report, 9:32529 (R;US)

ALPHATECH, Inc., Burlington, MA (USA)
Information flow in event-driven large-scale systems, 9:33475 (R;US)
Optimal stochastic operations scheduling, 9:33472 (R;US)

Aluminum Co. of America, Alcoa Center, PA. Alcoa Technical Center
Pulverized coal firing of aluminum melting furnaces. Final report, 9:32619 (R;US)

Alzeta Corp., Mountain View, CA (USA)
Advanced furnace concepts - commercial unit heater. Annual report Sep 82-Oct 83, 9:33933 (R;US)
Firetube boiler fiber burner demonstration program. Annual report Sep 82-Oct 83, 9:33932 (R;US)
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Qualifier
Title, (supplementary information), citation number, (R:US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC02-76CS40202	**Arizona State Univ., Tempe (USA). Dept. of Chemical Engineering**	
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AC02-76ER02978	**Cincinnati Univ., OH (USA)**	
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AC02-76ER04027	**Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering**	
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AC02-76ET37210	**Northwestern Univ., Evanston, IL (USA)**	
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AC02-81ER10908	**Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Materials and Metallurgical Engineering**	
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AC02-81EV10750	**Maine Univ., Orono (USA). Dept. of Botany and Plant Pathology**	
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AC02-82ER12058	**Colorado Univ., Boulder (USA). Dept. of Chemical Engineering**	
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AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
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AC02-84ER13163	**SKF Industries, Inc., King of Prussia, PA (USA)**	
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AC03-76SF00515	Stanford Linear Accelerator Center, CA (USA)	
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AC03-79CS40297	Varigas Research, Inc., Timonium, MD (USA)	
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AC03-83ER60148	S-Cubed, Albuquerque, NM (USA)	
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AC04-79ET20630	**Science Applications, Inc., McLean, VA (USA)**	
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AC05-76OR00033	**Oak Ridge Associated Universities, Inc., TN (USA)**	
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AC05-78OR03054	**International Coal Refining Co., Allentown, PA (USA)**	
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	SRI International, Menlo Park, CA (USA)	
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AC05-79ER10013	**Florida Univ., Gainesville (USA)**	
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AC05-81OR20722	**Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.**	
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AC05-84OR21400	**Oak Ridge National Lab., TN (USA)**	
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AC05-84OU21400	Paducah Gaseous Diffusion Plant, KY (USA)	
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AC06-76FF02170	Westinghouse Hanford Co., Richland, WA (USA)	
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	Hanford Engineering Development Lab., Richland, WA (USA)	
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AC06-76RL01830	Pacific Northwest Lab., Richland, WA (USA)	
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AC06-77RL01030	Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations	
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AC06-81ER40048	Washington Univ., Seattle (USA). Nuclear Physics Lab.	
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AC07-76GJ01664	Bendix Field Engineering Corp., Grand Junction, CO (USA)	
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AC07-76ID01570	EG and G Idaho, Inc., Idaho Falls (USA)	
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AC07-78CS40037	Aluminum Co. of America, Alcoa Center, PA. Alcoa Technical Center	
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AC08-76NV00597	Westinghouse Research and Development Center, Pittsburgh, PA	
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AC08-82NV10250	Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.	
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AC08-83NV10282	Brookhaven National Lab., Upton, NY (USA)	
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AC08-84NV10327	Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)	
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AC11-76PN00292	**Duquesne Light Co., Shippingport, PA (USA)**	
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AC18-84FC10614	**Brigham Young Univ., Provo, UT (USA). Combustion Lab.**	
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AC20-83LC10977	**Emerald Exploration Consultants, Inc., Austin, TX (USA)**	
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AC21-78ET10328	**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**	
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AC21-80ET14705	**Institute of Gas Technology, Chicago, IL (USA)**	
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AC21-80MC14386	**USDOE Morgantown Energy Technology Center, WV**	
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AC21-80MC14593	**SRI International, Menlo Park, CA (USA)**	
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AC22-81PC30019	Air Products and Chemicals, Inc., Allentown, PA (USA)	
	9:32794	DOE/PC/30019—T11
AC22-81PC40268	Foster Wheeler Development Corp., Livingston, NJ (USA)	
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AC22-82FE60148	NOXSO Corp., Paducah, KY (USA)	
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AC22-82PC50001	Gulf Research and Development Co., Shawnee Mission, KS (USA)	
	9:32516	DOE/PC/50001—15
AC22-82PC50041	Catalytic, Inc., Wilsonville, AL (USA)	
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AC22-82PC50051	Aspen Technology, Inc., Cambridge, MA (USA)	
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AC22-82PC50254	Advanced Fuel Research, Inc., East Hartford, CT (USA)	
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AC22-83PC60046	Gulf South Research Inst., New Orleans, LA (USA)	
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AC39-81RC11334	Ransom and Casazza, Inc., Washington, DC (USA)	
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AC79-82BP34337	United Industries Corp., Bellevue, WA (USA)	
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AC79-83BP11551	ECO Northwest (USA)	
	9:32567	DOE/BP—255
AI01-76IR08323	Department of Energy, Washington, DC (USA)	
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AI01-77CS51040	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
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AI01-79ER10035	Raytheon Co., Wayland, MA (USA)	
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AI01-80CS50194	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
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AI01-81CS90103	Regional Planning Council, Baltimore, MD (USA)	
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AI01-81FE00016	Foster-Miller, Inc., Waltham, MA (USA)	
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AI21-80ET17088	Energy Research Corp., Danbury, CT (USA)	
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AS05-76ER05223	Texas A and M Univ., College Station (USA). Dept. of Physics	
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AS05-76ET53045	College of William and Mary, Williamsburg, VA	
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AS05-83ER45022	West Virginia Univ., Morgantown (USA). Dept. of Physics	
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AS05-83ER45039	Florida Univ., Gainesville (USA). Dept. of Materials Science and Engineering	
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AS20-80LC10350	California Univ., Berkeley (USA). Dept. of Chemical Engineering	
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AT01-76EV70012	Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.	
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AT01-80NE93030	National Research Council, Washington, DC (USA). Panel on Social and Economic Aspects of Radioactive Waste Management	
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AT03-76ER72018	Stanford Univ., CA (USA). Systems Optimization Lab.	
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AT03-76ET12084	University of Southern California, Los Angeles (USA). Dept. of Petroleum Engineering	
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AT03-80ET27252	**California Univ., Berkeley (USA). Dept. of Mechanical Engineering**	
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AT03-84SF11962	**GA Technologies, Inc., San Diego, CA (USA)**	
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AT03-84SF11963	**GA Technologies, Inc., San Diego, CA (USA)**	
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AT06-76ER70004	**Illinois Inst. of Tech., Chicago (USA). Dept. of Physics**	
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AT06-79ER10405	**Oregon State Univ., Corvallis (USA). Dept. of Physics**	
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AT06-79ER10416	**Washington Univ., Seattle (USA). Dept. of Electrical Engineering**	
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FC07-80ID12201	**Energy Research and Applications, Inc., Santa Monica, CA (USA)**	
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FC21-83FE60181	**North Dakota Univ., Grand Forks (USA). Energy Research Center**	
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FG01-79RG10063	**Michigan State Univ., East Lansing (USA). Center for Evaluation and Assessment**	
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FG01-82CE15140	**Solar Option One Co., Lyndonville, VT (USA)**	
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FG22-82PC50793	Auburn Univ., AL (USA)	
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FG22-83PC60783	Air Products and Chemicals, Inc., Allentown, PA (USA)	
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FG22-83PC60791	Yale Univ., New Haven, CT (USA). Dept. of Chemistry	
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FG22-83PC60812	Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering	
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FG22-83PC61256	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
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FG47-80R701142	Solar Greenhouse Association, Webster Groves, MO (USA)	
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	See INIS-mf-8903	DE84780391	MN -20	9:34851
CONF-830311-	(Particle accelerator conference, Santa Fe, NM, USA, 21-23 Mar 1983)			
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3057-3059(Aug 1983)			9:32696
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3121-3123(Aug 1983)			9:33871
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3250-3251(Aug 1983)			9:33969
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3286-3290(Aug 1983)			9:33970
	IEEE Trans. Nucl. Sci., NS-30: 3063-(Aug 1983)			9:33971
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3076-3077(Aug 1983)			9:34006
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2690-2692(Aug 1983)			9:34007
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3174-3176(Aug 1983)			9:34008
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3326-3329(Aug 1983)			9:34009
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3078-3082(Aug 1983)			9:34010
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2728-2730(Aug 1983)			9:34100
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2705-2707(Aug 1983)			9:34102
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3299-3303(Aug 1983)			9:34103
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 2680-2684(Aug 1983)			9:34104
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3262-3266(Aug 1983)			9:34105
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3360-3362(Aug 1983)			9:34106
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3130-3132(Aug 1983)			9:34111
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3055-3056(Aug 1983)			9:34965
	IEEE Trans. Nucl. Sci., NS-30: No. 4, 3073-3075(Aug 1983)			9:34966
CONF-8303121-	(Microscopy of semiconducting materials meeting, Oxford, UK, 21-23 Mar 1983)			
	Inst. Phys., Conf. Ser., 143-148(1983)			9:33764
CONF-830443-	(Metallurgical coatings conference, San Diego, CA, USA, 18-22 Apr 1983)			
	Thin Solid Films, 108: No. 4, 383-393(28 Oct 1983)			9:33715
CONF-830491-	(PCI/MOTORCON 83 conference, Orlando, FL, USA, 19-21 Apr 1983)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012878	MN -38	9:33858
CONF-830514-	(Offshore technology conference, Houston, TX, USA, 2-5 May 1983)			
2	*See* GKSS-83/E/24	DE84751288	MN -92a	9:33937
CONF-830561-	(3. national symposium on aquifer restoration and ground water monitoring, Columbus, OH, USA, 25-27 May 1983)			
4	*See* LBL-15701	DE84013392	MN -11	9:34356
CONF-830567-	(5. symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, USA, 10-13 May 1983)			
	Biotechnol. Bioeng. Symp., No. 13, 401-420(1983)			9:32566
	Biotechnol. Bioeng. Symp., No. 13, 271-276(1983)			9:32779
	John Wiley and Sons, Inc., 605 Third Avenue, New York, NY 10158			9:32798
	Biotechnol. Bioeng. Symp., No. 13, 183-191(1983)			9:32799
	Biotechnol. Bioeng. Symp., No. 13, 193-205(1983)			9:32800
	Biotechnol. Bioeng. Symp., No. 13, 265-269(1983)			9:32801
	Biotechnol. Bioeng. Symp., No. 13, 287-298(1983)			9:32802
	Biotechnol. Bioeng. Symp., No. 13, 557-566(1983)			9:32803
	Biotechnol. Bioeng. Symp., No. 13, 663-668(1983)			9:32804
	Biotechnol. Bioeng. Symp., No. 13, 99-111(1983)			9:32868
	Biotechnol. Bioeng. Symp., No. 13, 239-244(1983)			9:34388
CONF-8305195-	(Meeting on phenomenology of modern unified field theories from standard model to supersymmetries, Dubrovnik, Yugoslavia, 22-28 May 1983)			
1	*See* LAL-83-26	DE84751564	MN -34D	9:34620
CONF-8305200-	(Symposium on the Southern Appalachian spruce-fir ecosystem: status, threats, and management, Gatlinburg, TN, USA, 1 May 1983)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012353	MN -11	9:34335
CONF-830632-	(3. international conference on emerging nuclear energy systems, Helsinki, Finland, 6-9 Jun 1983)			
	See KFK-3563			9:34945
CONF-830670-	(International conference on subsurface heat storage in theory and practice, Stockholm, Sweden, 6-8 Jun 1983)			
4	*See* LBL-14957	DE84013393	MN -59	9:32953
CONF-830674-	(6. international Balaton topical conference on high energy nuclear physics, Balatonfured, Hungary, 6-11 Jun 1983)			
	See INIS-mf-8935	DE84780275	MN -34B	9:34586
CONF-830685-	(NATO Advanced Research Institute workshop on high speed computation, Juelich, F.R. Germany, 20-22 Jun 1983)			
2	*See* UCRL-89165	DE84012374	MN -32	9:35003
CONF-8306136-	(International symposium on quarks and nuclear structure, Bad Honnef, F.R. Germany, 13-16 Jun 1983)			
5	*See* DOE/ER/40048-23-N3	DE84013843	MN -34C	9:34723
CONF-8306178-	(German radiological congress, Hanover, F.R. Germany, 16-18 Jun 1983)			
Absts.	*See* INIS-mf-8716	DE84780248	MN -48	9:34412

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CONF-8306180-	(8. All-union seminar on linear accelerators, Kharkov, Ukrainian SSR, 1 Jun 1983)			
No.2(14)	*See* INIS-SU-221	DE84780353	MN -28	9:33962
CONF-8306181-	(Symposium on condenser macrofouling control technologies, Hyannis, MA, USA, 1-3 Jun 1983)			
	See EPRI-CS-3343	TI84920275	ND -90i	9:34354
CONF-830718-	(International Europhysics conference on high energy physics, Brighton, UK, 20-27 Jul 1983)			
26	*See* KFK-3643	DE84751448	MN -34D	9:34603
CONF-830765-	(6. computer security conference, Denver, CO, USA, 25-28 Jul 1983)			
Summs.	*See* LALP-84-13(3-84)	DE84011742	MN -32	9:34989
CONF-8307118-	(1. international conference on the use of fly ash, silica, fume and other mineral by-products in concrete, Montebello, Canada, 31 Jul-5 Aug 1983)			
1	*See* GKSS-83/E/59	DE84751493	MN -80	9:33269
CONF-8307120-	(Meeting on astrophysics and fundamentals interactions, Gargese, France, 25-29 Jul 1983)			
1	*See* CEA-CONF-6877	DE84751572	MN -34D	9:34523
CONF-830807-	(International conference on coal science, Pittsburgh, PA, USA, 15-19 Aug 1983)			
15	*See* IS-M-462	DE84012135	MN -90d	9:32608
CONF-8308101-	(International symposium on lepton and photon interactions at high energies, Ithaca, NY, USA, 4-9 Sep 1983)			
12	*See* DESY-83-100	DE84751487	MN -34D	9:34589
CONF-8308131-	(3. international conference on physics in collision, Como, Italy, 31 Aug-2 Sep 1983)			
6	*See* DESY-83-117	DE84751481	MN -34D	9:34592
CONF-8308149-	(Conference on glass in planetary and geological phenomena, Alfred, NY, USA, 14-18 Aug 1983)			
3	*See* UCRL-89787	DE84012808	MN -11	9:34509
CONF-8308160-	(International school of intermediate energy nuclear physics, San Miniato, Italy, 19-28 Aug 1983)			
2	*See* CEA-CONF-7049	DE84751559	MN -34D	9:34631
CONF-8308177-	(Gordon conference on nuclear structure, Tilton, NH, USA, 15-19 Aug 1983)			
Summ.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013277	MN -34	9:34648
CONF-830903-	(IEEE international conference on computer-aided design, Santa Clara, CA, USA, 12-14 Sep 1983)			
2	*See* SAND-84-1086C	DE84013213	MN -92a	9:32680
CONF-8309168-	(3. international conference on ultra-relativistic nucleus-nucleus collisions, Upton, NY, USA, 26-30 Sep 1983)			
6	*See* DOE/ER/70004-376	DE84013751	MN -34C	9:34724
CONF-8309204-	(INS symposium on high energy photonuclear reactions and related topics, Tokyo, Japan, 29 Sep-1 Oct 1983)			
2	*See* BONN-HE-83-22	DE84751434	MN -34C	9:34647
CONF-8309215-	(Joint annual meeting of the Austrian Society for Internal Medicine, the Austrian Rheumatologic League and the Austrian Society for Nuclear M, Salzburg, Austria, 22-24 Sep 1983)			
Absts.	*See* INIS-mf-8902	DE84780308	MN -48	9:34415
CONF-8309217-	(6. European conference on soft magnetic materials, Eger, Hungary, 6-9 Sep 1983)			
Absts.	*See* INIS-mf-8934	DE84780273	MN -34A	9:33664
CONF-8309219-	(International school of elementary particle physics, Kupari, Yugoslavia, 18 Sep-2 Oct 1983)			
2	*See* MPI-PAE/Exp.El.-120	DE84751424	MN -34D	9:34621
CONF-8309223-	(1. international workshop on carcinogenic and/or mutagenic metals, Geneva, Switzerland, 11-14 Sep 1983)			
1	*See* SVC-83-38	TI84751001	ND -11	9:34246
CONF-8309242-	(Meeting of the French Society of Physics, Grenobel, France, 19-23 Sep 1983)			
1	*See* CEA-CONF-7088	DE84751575	MN -21	9:34840
CONF-8309243-	(4. ESARDA workshop on the fabrication of mixed oxide fuels, Risley, UK, 27-28 Sep 1983)			
1	*See* CEA-CONF-7123	DE84751576	MN -16	9:32765
CONF-8309252-	(NATO Advanced Research workshop on vectorization of advanced methods for molecular electronic structure, Colorado Springs, CO, USA, 25-29 Sep 1983)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013422	MN -4	9:34558
CONF-831042-	(Symposium on urban applications of HVDC power transmission, Philadelphia, PA, USA, 24-26 Oct 1983)			
	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84012565	MN -97a	9:33044
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)			
100	NTIS, PC A02/MF A01 (GPO Dep.)	DE84002832	MN -70B	9:32718
CONF-831063-	(American Institute of Chemical Engineers fall annual meeting, Washington, DC, USA, 30 Oct-3 Nov 1983)			
14	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013948	MN -90c	9:33881
CONF-8310143-	(11. NRC water reactor safety research information meeting, Gaithersburg, MD, USA, 14-24 Oct 1983)			
Vol.5	*See* NUREG/CP-0048-Vol.5	DE84900649	MN -78	9:33303
CONF-8310195-	(Industrial wood energy forum, Nashville, TN, USA, 15 Oct 1983)			
2	*See* PNL-SA-11448	DE84013264	MN -61D	9:32789

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CONF-8310205-	(TMS-AIME fall meeting, Philadelphia, PA, USA, 2-6 Oct 1983)			
10	*See* BNL-34778	DE84012911	MN -25	9:33623
CONF-8310265-	(International symposium on the theory of elementary particles, Ahrenshoop, German D.R., 9-15 Oct 1983)			
1	*See* DESY-83-120	DE84751486	MN -34D	9:34636
4	*See* BONN-HE-83-23	DE84751433	MN -34D	9:34630
CONF-8310269-	(French-Japanese colloquium on comparison between hadronic and nuclear research at intermediate energies, Dogashima, Japan, 3-7 Oct 1983)			
2	*See* CEA-CONF-7095	DE84751573	MN -34D	9:34671
3	*See* CEA-CONF-7127	DE84751585	MN -34D	9:34687
CONF-831175-	(6. international conference on nondestructive evaluation in the nuclear industry, Zurich, Switzerland, 27 Nov-2 Dec 1983)			
8	*See* CEA-CONF-7084	DE84751568	MN -78	9:33068
CONF-8311150-	(5. DOE/BES meeting on basic heterogeneous catalysis surface science research, Gaithersburg, MD, USA, 7-9 Nov 1983)			
Summs.	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013676	MN -4	9:32442
CONF-8311163-	(North-German expert meeting on energy conservation in space heating - practical examples, Kiel, F.R. Germany, 22 Nov 1983)			
1-Summ.	NTIS (US Sales Only), PC A02/MF A01	DE84770331	MN -95	9:33457
CONF-8311171-	(EPRI nondestructive examination information meeting, Palo Alto, CA, USA, 10-11 Nov 1983)			
	See EPRI-NP-3347-SR	TI84920314	ND -80	9:33913
CONF-8311175-	(95. annual convention and regulatory symposium of the National Association of Regulatory Utility Commissioners (NARUC), Detroit, MI, USA, 14-17 Nov 1983)			
	Energy Policy, 12: No. 2, 219-220(Jun 1984)			9:33583
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
158	*See* GA-A-17379	DE84012962	MN -20a	9:34848
159	*See* GA-A-17377	DE84012961	MN -20d	9:34846
160	*See* GA-A-17378	DE84012958	MN -20b	9:34847
161	*See* GA-A-17380	DE84012963	MN -20d	9:34849
162	*See* UCRL-89546	DE84013070	MN -21	9:34959
CONF-840101-	(Winter conference on plasma spectrochemistry, San Diego, CA, USA, 2-6 Jan 1984)			
3	*See* IS-M-476	DE84014126	MN -4	9:33804
CONF-840139-	(SPIE technical symposium and instrument exhibit, Los Angeles, CA, USA, 22-27 Jan 1984)			
6	*See* UCRL-90295	DE84012676	MN -38	9:33924
CONF-840145-	(INDO-US workshop on diffusion in solids, Bombay, India, 9-13 Jan 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013458	MN -34	9:34762
CONF-840150-	(4. Moriond workshop on massive neutrinos in particle and astro-physics, La Plagne, France, 15-21 Jan 1984)			
6	*See* FERMILAB-CONF-84/40-T	DE84013083	MN -34B	9:34525
CONF-840159-	(Seminar on energy-relevant activities, Vienna, Austria, 17 Jan 1984)			
	See OEFZS-4266			9:33041
CONF-840160-	(EM/GT/ST specialty conference, Berkeley, CA, USA, 1 Jan 1984)			
1	*See* IS-M-475	DE84014128	MN -80	9:33288
CONF-840202-	(17. midyear topical meeting of the Health Physics Society, Pasco, WA, USA, 5-9 Feb 1984)			
26	*See* TRI-PP-84-7	DE84901239	MN -41	9:34463
CONF-840275-	(Workshop on anti pp options for the SSC, Chicago, IL, USA, 13-17 Feb 1984)			
9	*See* FERMILAB-Conf-84/29-THY	DE84012704	MN -34C	9:34107
10	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013481	MN -34D	9:34628
CONF-840290-	(National symposium on thermally stimulated luminescence and related phenomena, Ahmedabad, India, 1 Feb 1984)			
1	*See* BNL-34839	DE84013226	MN -4	9:34112
CONF-840307-	(Waste management '84, Tucson, AZ, USA, 11-15 Mar 1984)			
44	*See* BNL-34796	DE84013234	MN -70	9:32716
45	*See* RHO-BW-SA-311-P	DE84013200	MN -70	9:32738
46	*See* BNL-34795	DE84013127	MN -70	9:32715
CONF-840374-	(APCA specialty meeting on environmental impact of natural emissions, Research Triangle Park, NC, USA, 7-9 Mar 1984)			
4	*See* PNL-SA-12117	DE84013261	MN -11	9:34244
CONF-840385-	(15. lunar and planetary science conference, Houston, TX, USA, 12-16 Mar 1984)			
3	*See* LA-UR-84-1595	DE84012435	MN -34B	9:34549
CONF-8403119-	(OHOLO conference on boundary layer structure, Zichron Ya'acov, Israel, 25-28 Mar 1984)			
2	*See* UCRL-90053	DE84013076	MN -11	9:34183
CONF-8403121-	(New particle production at high energy meeting: The Recontre de Moriond, La Plagne, France, 4-10 Mar 1984)			
4	*See* LBL-17806	DE84013241	MN -34D	9:34604

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CONF-8403128-	(Association for Computing Machinery North Central Region conference on making the micro to mainframe connection, Chicago, IL, USA, 23 Mar 1984)			
1	NTIS, PC A02; 3 (GPO Dep.)	DE84010508	MN -32	9:34979
CONF-8403130-	(4. topical workshop on proton antiproton collider physics, Bern, Switzerland, 5-8 Mar 1984)			
1	*See* BNL-34728	DE84012910	MN -34D	9:34608
2	*See* LBL-17719	DE84013237	MN -28	9:33965
3	*See* FERMILAB-Conf-84/49-T	DE84013081	MN -34D	9:34599
CONF-8403131-	(EPA symposium on short-term genetic bioassays in the evaluation of complex environmental mixtures, Chapel Hill, NC, USA, 27-29 Mar 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013434	MN -90i	9:32643
CONF-840403-	(4. international symposium on gaseous dielectrics, Knoxville, TN, USA, 29 Apr-3 May 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84011658	MN -97a	9:33045
CONF-840405-	(NACE corrosion '84 international forum and exhibition, New Orleans, LA, USA, 1-6 Apr 1984)			
13	*See* LBL-17237	DE84013390	MN -25	9:33680
CONF-840415-	(187. national meeting of the American Chemical Society, St. Louis, MO, USA, 8-13 Apr 1984)			
24	*See* LBL-17822	DE84013240	MN -4	9:34567
25	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013444	MN -4	9:33812
CONF-840493-	(Energy from biomass technical review meeting, Portland, OR, USA, 23-25 Apr 1984)			
2	*See* SERI/TP-231-2348	DE84004506	STD -61A	9:32790
CONF-8404106-	(International symposium on the properties and applications of metal hydrides, Eilat, Israel, 9-13 Apr 1984)			
4	*See* BNL-34830	DE84013090	MN -94d	9:32780
5	*See* BNL-34831	DE84013091	MN -94d	9:32781
7	*See* IS-M-480	DE84014123	MN -34	9:33671
CONF-8404110-	(4. international conference on high temperature science - HYTHERM, Santa Fe, NM, USA, 2-6 Apr 1984)			
6	*See* IS-M-491	DE84014125	MN -4	9:33816
CONF-8404119-	(Workshop on gauge theory on a lattice, Argonne, IL, USA, 5-7 Apr 1984)			
3	*See* FERMILAB-Conf-84/41-T	DE84012702	MN -34C	9:34638
4	*See* ANL-HEP-CP-84-21	DE84013440	MN -34	9:34629
5	*See* FERMILAB-Conf-84/48-T	DE84013082	MN -34D	9:34639
CONF-8404123-	(2. symposium on energy engineering sciences, Argonne, IL, USA, 10-12 Apr 1984)			
5	*See* EGG-M-11584	DE84012544	MN -34	9:33912
CONF-8404124-	(SPIE technical symposium, Arlington, VA, USA, 29 Apr-4 May 1984)			
8	*See* UCRL-90866	DE84012956	MN -25	9:33763
CONF-8404143-	(10. international conference on cyclotrons and their applications, East Lansing, MI, USA, 30 Apr-3 May 1984)			
7	*See* LBL-17068	DE84013394	MN -28	9:34095
CONF-8404146-	(International workshop on fundamental aspects of post-dryout heat transfer, Salt Lake City, UT, USA, 2-4 Apr 1984)			
4	*See* LA-UR-84-1586	DE84012439	MN -78	9:33296
CONF-8404149-	(International symposium on environmental pollution and man, Cape Town, South Africa, 30 Apr-4 May 1984)			
2	*See* BNL-34848	DE84013229	MN -48	9:34472
3	*See* BNL-34807	DE84013230	MN -48	9:34470
4	*See* BNL-34847	DE84013228	MN -48	9:34471
CONF-8404163-	(6. international conference on high energy physics, Nashville, TN, USA, 5-7 Apr 1984)			
2	*See* LBL-17845	DE84013236	MN -34D	9:34605
CONF-8404166-	(17. symposium on quantum chemistry and biochemistry: dynamics of molecule-surface interaction, Jerusalem, Israel, 30 Apr-3 May 1984)			
1	*See* LBL-17670	DE84011442	MN -34A	9:34566
CONF-8404170-	(3. international symposium on acceleration mass, Zurich, Switzerland, 10-13 Apr 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013439	MN -34C	9:34014
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013446	MN -34C	9:34680
CONF-840501-	(Meeting of the American Association for the Advancement of Science, New York, NY, USA, 24-29 May 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013454	MN -11	9:34223
CONF-840512-	(6. congress of the International Radiation Protection Association, Berlin, F.R. Germany, 7-12 May 1984)			
11	*See* PNL-SA-10985	DE84013252	MN -41	9:34136
12	*See* PNL-SA-10992	DE84013251	MN -41	9:34462
14	*See* PNL-SA-10915	DE84013254	MN -41	9:32761
CONF-840520-	(6. international conference on plasma surface interactions in controlled fusion devices, Nagoya, Japan, 14-18 May 1984)			
7	*See* SAND-83-2629C	DE84012277	MN -20c	9:34953
8	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012346	MN -20a	9:34841
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013425	MN -25	9:33625
CONF-840529-	(Linear accelerator conference, Darmstadt-Seeheim, F.R. Germany, 7-11 May 1984)			
38	*See* SLAC-PUB-3331	DE84012511	STD -28	9:34098

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CONF-840530-	(International symposium on in-beam nuclear spectroscopy, Debrecen, Hungary, 14-18 May 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012326	MN -34C	9:34702
4	*See* BNL-34846	DE84013142	MN -34C	9:34658
5	*See* BNL-34812	DE84013145	MN -28	9:34013
CONF-840531-	(6. annual symposium on safeguards and nuclear material management, Venice, Italy, 14-18 May 1984)			
11	*See* K/OA-5672	DE84012801	MN -4	9:32699
12-Draft	*See* BNL-34804-Draft	DE84013227	MN -15	9:32763
13	*See* BNL-34806	DE84013232	MN -15	9:32764
CONF-840561-	(17. IEEE photovoltaic specialists conference, Kissimmee, FL, USA, 1-4 May 1984)			
13	*See* SERI/TP-212-2323	DE84004508	STD -63	9:32866
CONF-840570-	(Materials for future energy systems conference, Washington, DC, USA, 1-3 May 1984)			
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012328	MN -80	9:33113
CONF-840572-	(International symposium on observation of the continental crust through drilling, Tarrytown, NY, USA, 20-25 May 1984)			
2	*See* LA-UR-84-1639	DE84012452	MN -66b	9:32962
CONF-840576-	(International symposium on circuits and systems - ISCAS'84, Montreal, Canada, 7-10 May 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014007	MN -97c	9:33046
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013871	MN -97c	9:33016
CONF-8405106-	(Building innovative concepts fair, Arlington, VA, USA, 23 May 1984)			
	See PNL-SA-12234	DE84013410	MN -59	9:33540
CONF-8405122-	(International symposium on hydrogen produced from renewable energy, Manoa, HI, USA, 24-25 May 1984)			
1	*See* BNL-34689	DE84012908	MN -94d	9:32776
CONF-8405144-	(International groundwater symposium, Montreal, Quebec, Canada, 21-23 May 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012356	MN -11	9:33935
CONF-8405153-	(Horizontal-axis wind turbine technology conference, Cleveland, OH, USA, 8-10 May 1984)			
2	*See* PNL-SA-12245	DE84013269	MN -60	9:33009
3	*See* PNL-SA-12244	DE84013267	MN -60	9:33008
CONF-8405154-	(American Institute of Chemical Engineers spring national meeting, Anaheim, CA, USA, 20-23 May 1984)			
5-Draft	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012359	MN -90a	9:32543
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012347	MN -90i	9:32658
CONF-8405157-	(16. biomass thermochemical conversion contractors meeting, Portland, OR, USA, 8-9 May 1984)			
2	*See* PNL-SA-12259	DE84013259	MN -61D	9:32797
CONF-8405162-	(Symposium on recent developments in computing, processor, and software research for high-energy physics, Guanajuato, Mexico, 8-11 May 1984)			
2	*See* BNL-34758	DE84013233	MN -28	9:33974
CONF-8405179-	(International conference on theoretical approaches to heavy ion reaction mechanisms, Paris, France, 14-18 May 1984)			
2	*See* LBL-17837	DE84013247	MN -34C	9:34743
CONF-8405183-	(Joint Army Navy Nasa Air Force S and EPS annual meeting, Las Cruces, NM, USA, 7-11 May 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013436	MN -37	9:34144
CONF-8405187-	(Plasmids in bacteria research conference, Urbana, IL, USA, 14-18 May 1984)			
1	*See* BNL-34783	DE84012898	MN -48	9:34430
CONF-8405188-	(Engineering faculty meeting, Los Alamos, NM, USA, 30 May-1 Jun 1984)			
1	*See* LA-UR-84-1721	DE84012585	MN -78	9:33297
CONF-8405189-	(4. international symnposium on gaseous dielectrics, Knoxville, TN, USA, 3-9 May 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012342	MN -41	9:34473
CONF-8405190-	(9. chemical vapor deposition conference, Cincinnati, OH, USA, 6 May 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012351	MN -90h	9:33702
CONF-8405191-	(International symposium on the nuclear accelerator impact in the interdisciplinary field, Padova, Italy, 30 May-1 Jun 1984)			
1	*See* SAND-84-0744C	DE84012551	MN -28	9:34573
CONF-8405193-	(Conference on the intersections between particle and nuclear physics, Steamboat, CO, USA, 23-30 May 1984)			
5	*See* LA-UR-84-2027	DE84014025	MN -34D	9:34742
8	*See* LA-UR-84-1872	DE84013902	MN -34D	9:34740
9	*See* LA-UR-84-1871	DE84013901	MN -34D	9:34657
10	*See* LA-UR-84-1855	DE84013900	MN -34C	9:34739
11	*See* LA-UR-84-1873	DE84013903	MN -34D	9:34741
12	*See* LA-UR-84-1849	DE84013899	MN -34D	9:34738
CONF-8405194-	(5. annual conference and exposition of the National Computer Graphics Association, Anaheim, CA, USA, 13-17 May 1984)			
1	*See* PNL-SA-12161	DE84013256	MN -32	9:34994
2	*See* PNL-SA-12095	DE84013250	MN -32	9:34785

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CONF-8405195-	(State Radiation Program Directors conference, Des Moines, IA, USA, 21-24 May 1984)			
1	*See* PNL-SA-12284	DE84013248	MN -70B	9:32759
CONF-8405196-	(82. annual convention of the National Lime Association, Charleston, SC, USA, 17-18 May 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013457	MN -90i	9:32553
CONF-840604-	(12. international symposium on effects of radiation on materials, Williamsburg, VA, USA, 18-20 Jun 1984)			
7	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013423	MN -25	9:33626
CONF-840610-	(Windows in building design and maintenance conference, Gothenburg, Sweden, 13-15 Jun 1984)			
1	*See* LBL-17476	DE84013389	MN -95d	9:33519
CONF-840612-	(Air Pollution Control Association annual meeting, San Francisco, CA, USA, 25-28 Jun 1984)			
12	*See* DP-MS-84-38	DE84013146	MN -11	9:34299
CONF-840614-	(Annual meeting of the American Nuclear Society, New Orleans, LA, USA, 3-8 Jun 1984)			
58	*See* UCRL-90200	DE84012955	MN -20f	9:34960
59	*See* PNL-SA-12282	DE84013266	MN -70	9:32737
60	*See* GA-A-17559	DE84013344	MN -77	9:33089
62	*See* DP-MS-84-7	DE84013364	MN -70B	9:32724
63	*See* BNL-34825	DE84013128	MN -70	9:32717
64	*See* DP-MS-83-126	DE84013168	MN -70	9:32723
65	*See* HEDL-SA-3019-S	DE84013939	MN -79d	9:33094
CONF-840627-	(29. annual meeting of the Health Physics Society, New Orleans, LA, USA, 3-7 Jun 1984)			
4	*See* UCRL-90095	DE84013336	MN -41	9:34174
CONF-840629-	(13. international quantum electronics conference, Anaheim, CA, USA, 18-21 Jun 1984)			
4	*See* UCRL-90154	DE84013089	MN -38	9:33923
CONF-840647-	(ASME pressure vessel and piping conference, San Antonio, TX, USA, 17-21 Jun 1984)			
18	*See* SAND-84-1297C	DE84013057	MN -38	9:33868
19	*See* IS-M-486	DE84013730	MN -80	9:33289
20	*See* IS-M-488	DE84013729	MN -25	9:33915
21	*See* IS-M-489	DE84013727	MN -80	9:33290
CONF-840652-	(American Automatic Control conference, San Diego, CA, USA, 6-8 Jun 1984)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013872	MN -97c	9:33017
CONF-840677-	(6. DOE battery and electrochemical contractors' conference, Washington, DC, USA, 25-29 Jun 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013435	MN -94c	9:33369
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013428	MN -94cc	9:33370
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013427	MN -94cb	9:33371
Suppl.	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013678	STD -94c	9:33372
CONF-840695-	(4. annual advanced gasification contractors' meeting, Morgantown, WV, USA, 26-28 Jun 1984)			
2	*See* PNL-SA-12342	DE84013265	MN -90c	9:32536
CONF-8406111-	(International Energy Agency workshop on the design and performance of large solar thermal collectors, San Diego, CA, USA, 11-13 Jun 1984)			
2	*See* SAND-84-1042C	DE84012552	MN -59a	9:32944
CONF-8406113-	(5. IMACS international symposium, Bethlehem, PA, USA, 19-21 Jun 1984)			
3	*See* LA-UR-84-1717	DE84012582	MN -32	9:34784
4	*See* LA-UR-84-1676	DE84012445	MN -32	9:34986
CONF-8406119-	(31. power sources symposium, Cherry Hills, NY, USA, 12 Jun 1984)			
2	*See* SAND-83-2273C	DE84012812	MN -94cb	9:33385
CONF-8406124-	(2. workshop on containment integrity, Washington, DC, USA, 13-15 Jun 1984)			
4	*See* SAND-84-1233C	DE84012901	MN -78	9:33340
5	*See* SAND-84-0798C	DE84012960	MN -80	9:33337
6	*See* SAND-84-0722C	DE84013055	MN -78	9:33336
7	*See* SAND-84-0839C	DE84012550	MN -80	9:33339
8	*See* SAND-84-0807C	DE84012810	MN -80	9:33338
CONF-8406131-	(1. SP-100 program integration meeting, Danvers, MA, USA, 13-15 Jun 1984)			
3	*See* LA-UR-84-1704	DE84012580	MN -38	9:33907
CONF-8406132-	(75. annual international district heating conference, Bretton Woods, NH, USA, 17-21 Jun 1984)			
1	*See* BNL-34540	DE84012902	MN -95d	9:33577
CONF-8406133-	(DARPA propagation meeting, Monterey, CA, USA, 18-22 Jun 1984)			
1	*See* UCRL-90858	DE84012799	MN -28	9:34004
2	*See* UCRL-90886	DE84013335	MN -28	9:34005
CONF-8406134-	(Workshop on fundamental geochemistry needs for nuclear waste isolation, Los Alamos, NM, USA, 20-21 Jun 1984)			
1	*See* UCRL-90846	DE84012807	MN -70	9:32742
CONF-8406135-	(International conference on reliability and quality control, Columbia, MO, USA, 4-8 Jun 1984)			
1	*See* SAND-84-1199C	DE84012813	MN -32	9:34172
CONF-8406136-	(JANNAF propulsion systems hazards meeting, Aberdeen, MD, USA, 18-22 Jun 1984)			
2	*See* UCRL-90322	DE84013209	MN -45	9:34164

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CONF-8406137-	(16. power modulator symposium, Arlington, VA, USA, 17-20 Jun 1984)			
1	*See* SAND-84-0269C	DE84012959	MN -37	9:33362
2	*See* UCRL-90394	DE84012806	MN -28	9:33968
3	*See* SAND-84-0508C	DE84013063	MN -21	9:34954
4	*See* SAND-83-2434C	DE84013126	MN -38	9:33921
5	*See* SAND-84-0529C	DE84013125	MN -21	9:33967
6	*See* SAND-84-0353C	DE84013216	MN -37	9:33922
9	*See* LA-UR-84-1962	DE84014036	MN -37	9:33919
CONF-8406138-	(8. inter-American conference on materials technology, San Juan, Puerto Rico, 25-29 Jun 1984)			
1	*See* UCRL-90657	DE84012689	MN -25	9:33733
CONF-8406139-	(9. international CODATA conference, Jerusalem, Israel, 24-28 Jun 1984)			
1	*See* UCRL-90276	DE84013210	MN -32	9:35008
CONF-8406142-	(Hazardous materials management conference, Philadelphia, PA, USA, 5-7 Jun 1984)			
1	*See* PNL-SA-12126	DE84013405	MN -70	9:32736
CONF-8406144-	(Research in arid and semiarid lands meeting, Washington, DC, USA, 4-6 Jun 1984)			
1	*See* PNL-SA-12129	DE84013404	MN -11	9:34334
CONF-8406148-	(4. international symposium on rapid methods and automation in microbiology, Berlin, F.R. Germany, 7-10 Jun 1984)			
1	*See* LA-UR-84-1796	DE84013894	MN -48	9:34431
CONF-840701-	(Topical meeting on fission product behavior and source term research, Snowbird, UT, USA, 15-19 Jul 1984)			
12	*See* SAND-83-2654C	DE84013060	MN -78	9:33334
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013424	MN -78	9:33253
CONF-840703-	(8. world conference on earthquake engineering, San Francisco, CA, USA, 21-28 Jul 1984)			
2	*See* UCRL-90766	DE84013218	MN -70	9:32762
CONF-840734-	(25. annual meeting of the Institute of Nuclear Materials Management, Columbus, OH, USA, 15-18 Jul 1984)			
1	*See* SAND-84-0463C	DE84013059	MN -15	9:32771
2	*See* LA-UR-84-1959	DE84014035	MN -15	9:32769
CONF-840748-	(8. international congress on catalysis, Berlin, F.R. Germany, 2-6 Jul 1984)			
1	*See* IS-M-473	DE84012309	MN -4	9:33821
CONF-840749-	(2. international conference on fixed-film biological processes, Arlington, VA, USA, 10-12 Jul 1984)			
1	*See* DOE/FE/60181-50	DE84013302	MN -90c	9:32555
CONF-840750-	(4. international drying symposium, Kyoto, Japan, 9-12 Jul 1984)			
1	*See* SAND-83-2332C	DE84013056	MN -25	9:33614
CONF-840754-	(5. annual meeting of the Fine Particle Society, Orlando, FL, USA, 30 Jul-1 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013432	MN -90a	9:32540
CONF-840801-	(20. international symposium on combustion, Ann Arbor, MI, USA, 12-17 Aug 1984)			
1	*See* UCRL-90251	DE84005739	MN -4	9:33849
2	*See* UCRL-90318	DE84006300	MN -45	9:34163
3	*See* UCRL-90319	DE84006301	MN -38	9:33909
4	*See* UCRL-90252	DE84006134	MN -96	9:33543
5	*See* LBL-17274	DE84006755	MN -11	9:34231
6	*See* SAND-84-8628	DE84007186	MN -96	9:32633
7	*See* LBL-17222	DE84006771	MN -4	9:33846
8	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007524	MN -90a	9:32617
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009328	MN -96	9:33510
10	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009773	MN -96	9:33511
11	*See* SAND-84-8640	DE84011405	MN -4	9:33848
14	*See* LBL-17220	DE84012257	MN -4	9:33845
CONF-840802-	(International topical meeting on fuel reprocessing and waste management, Jackson Hole, WY, USA, 26-29 Aug 1984)			
1	*See* HEDL-SA-3056-S	DE84007081	MN -79c	9:32700
CONF-840804-	(Intersociety energy conversion engineering conference, San Francisco, CA, USA, 19-24 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006420	MN -94b	9:33552
2-Draft	*See* SAND-84-0874C-Draft	DE84010599	MN -63	9:32908
4	*See* SAND-84-0053C	DE84010978	MN -63	9:32863
5	*See* GA-A-17495	DE84011154	MN -77	9:33117
6	*See* SAND-84-0982C	DE84011186	MN -94cb	9:33386
9	*See* SAND-84-0896C	DE84011483	MN -63	9:32909
10	*See* DOE/NASA-1005-3	DE84011501	STD -96	9:33594
11	*See* BNL-34731	DE84011913	MN -94cd	9:32777
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011725	MN -90f	9:33023
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012098	MN -96	9:33593
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011728	MN -96	9:33599
19	*See* LA-UR-84-1480	DE84012641	MN -80	9:33114
21	*See* SAND-84-1091C	DE84013058	MN -63	9:32910
22	*See* GA-A-17545	DE84013345	MN -38	9:33861
23	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013438	MN -94cb	9:33373
24	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013452	MN -94ca	9:33374
25	*See* GA-A-17555	DE84012571	MN -91	9:32654

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CONF-840805-	(188. meeting of the American Chemical Society, Philadelphia, PA, USA, 26-31 Aug 1984)			
1	*See* DOE/FE/60181-58	DE84009231	MN -90a	9:32449
2	*See* LA-UR-84-1041	DE84009987	MN -4	9:33817
3	*See* DOE/FE/60181-81	DE84010164	MN -90	9:32451
4	*See* DOE/FE/60181-72	DE84010161	MN -90a	9:32450
5	*See* SAND-84-0199C	DE84010270	MN -90d	9:32537
9	*See* DOE/PC/50786-7	DE84008848	MN -90a	9:32519
10	*See* SAND-84-0891C	DE84010299	MN -4	9:33731
12	*See* DOE/FE/60181-85	DE84009700	MN -90	9:32452
13	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012093	MN -90a	9:32618
14	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012097	MN -90a	9:32541
15	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012108	MN -90a	9:32542
16	*See* UCRL-90604	DE84012607	MN -4	9:33723
17	*See* UCRL-90642	DE84012605	MN -25	9:33732
CONF-840809-	(Geothermal Resources Council annual meeting, Reno, NV, USA, 27-29 Aug 1984)			
1	*See* LA-UR-84-1106	DE84010002	MN -66a	9:32978
2	*See* SAND-84-0757C	DE84010269	MN -66c	9:32985
3	*See* SAND-84-0756C	DE84009920	MN -66	9:32964
4	*See* SAND-84-0759C	DE84008852	MN -66a	9:32987
5	*See* SAND-84-0758C	DE84008840	MN -66b	9:32986
6	*See* LA-UR-84-1193	DE84011350	MN -66b	9:32979
13	*See* LBL-17644	DE84012251	MN -66a	9:32963
15	*See* LBL-17694	DE84012252	MN -66a	9:32982
16	*See* LA-UR-84-1900	DE84013906	MN -66b	9:32980
CONF-840813-	(Design, construction and operation of nuclear power plants conference, Portland, OR, USA, 5-8 Aug 1984)			
1	*See* LA-UR-83-3658	DE84004415	MN -78	9:33295
5	*See* SAND-84-0368C	DE84006959	MN -78	9:33335
CONF-840816-	(22. national heat transfer conference, Niagara Falls, NY, USA, 5-8 Aug 1984)			
1	*See* SAND-83-2358C	DE84002612	MN -38	9:33908
2	*See* LA-UR-84-166	DE84006016	MN -38	9:33905
3	*See* SAND-83-2393C	DE84006104	MN -80	9:33333
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006405	MN -38	9:33882
5	NTIS, PC A03/MF A01 (GPO Dep.)	DE84006412	MN -38	9:33883
6	NTIS, PC A; 3 (GPO Dep.)	DE84006593	MN -80	9:33254
7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006739	MN -78	9:33255
8	*See* LA-UR-84-499	DE84007504	MN -59c	9:32939
9	*See* SAND-84-0641C	DE84010143	MN -20	9:34955
10	*See* SAND-83-2375C	DE84011681	MN -63	9:32862
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011738	MN -64	9:32929
12	*See* SAND-84-0248C	DE84012234	MN -38	9:34154
13	*See* BNL-34707	DE84012899	MN -34	9:33880
CONF-840820-	(27. international geological congress, Moscow, USSR, 4-14 Aug 1984)			
1	*See* LA-UR-83-2489	DE83017313	MN -34B	9:33756
CONF-840828-	(International synfuels policies and technologies symposium, Philadelphia, PA, USA, 19-22 Aug 1984)			
1	*See* SAND-83-2330C	DE84007343	MN -4	9:33332
2	*See* DOE/FE/60181-23	DE84007671	MN -90i	9:32554
3	*See* PNL-SA-12032	DE84008314	MN -4	9:33809
CONF-840830-	(Crypto '83 conference, Santa Barbara, CA, USA, 22-24 Aug 1984)			
1	*See* SAND-83-2496C	DE84006964	MN -32	9:34995
CONF-840831-	(ASME international computers in engineering conference, Las Vegas, NV, USA, 12-16 Aug 1984)			
1	*See* HEDL-SA-3049	DE84006352	MN -79	9:33095
CONF-840833-	(5. American Society of Civil Engineers/Engineering Mechanics specialty conference, Laramie, WY, USA, 1-3 Aug 1984)			
1	*See* UCRL-90094	DE84008324	MN -38	9:33855
2	*See* LA-UR-84-924	DE84009969	MN -11	9:34519
3	*See* BNL-NUREG-34545	DE84010284	MN -80	9:33250
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009629	MN -79h	9:33256
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009587	MN -80	9:33151
CONF-840842-	(17. international conference on low temperature physics, Karlsruhe, F.R. Germany, 15-22 Aug 1984)			
1	*See* LA-UR-84-1088	DE84009995	MN -34	9:34565
2	*See* LA-UR-84-944	DE84009972	MN -34	9:34582
3	*See* LA-UR-84-904	DE84010076	MN -34	9:34580
4	*See* LA-UR-84-905	DE84010072	MN -34	9:34581
5	*See* LA-UR-84-1020	DE84009984	MN -34	9:34583
6	*See* LA-UR-84-1019	DE84009980	MN -25	9:33676
7	*See* LA-UR-84-1017	DE84009979	MN -25	9:33757
8	*See* LA-UR-84-1053	DE84009991	MN -25	9:33678
9	*See* LA-UR-84-1051	DE84009990	MN -34	9:33677
10	*See* LA-UR-84-1052	DE84009985	MN -34	9:34584
11	*See* LA-UR-84-889	DE84010068	MN -25	9:33675
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010519	MN -34	9:34577
13	*See* LA-UR-84-1203	DE84011333	MN -25	9:33679
14	*See* LA-UR-84-1202	DE84011413	MN -25	9:33758
15	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011721	MN -34	9:33627
16	NTIS, PC A02/MF A01 (GPO Dep.)	DE84011705	MN -34C	9:33701

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17	*See* LA-UR-84-1525	DE84012634	MN –34	9:33710
18	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013453	MN –34	9:33628
20	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013419	MN –34	9:33629
CONF-840845-	(10. annual conference of the Solar Energy Society of Canada, Calgary, Canada, 2-6 Aug 1984)			
1	*See* SAND-84-0244C	DE84012275	MN –63	9:32864
CONF-840848-	(42. annual Electron Microscopy Society of America meeting, Detroit, MI, USA, 13-17 Aug 1984)			
1-Abst.	*See* BNL-34648	DE84010796	MN –48	9:34376
2	*See* BNL-34634	DE84010285	MN –48	9:34375
3	*See* BNL-34662	DE84011564	MN –48	9:34377
CONF-840849-	(Annual meeting of the American Statistical Association (ASA), Philadelphia, PA, USA, 12-16 Aug 1984)			
1	*See* SAND-84-0479C	DE84010600	MN –32	9:34996
2	*See* LA-UR-84-1583	DE84012438	MN –32	9:34985
3	*See* LA-UR-84-1499	DE84012626	MN –32	9:34983
CONF-840850-	(CIRP assembly, Madison, WI, USA, 20-25 Aug 1984)			
1	*See* UCRL-90475	DE84011059	MN –38	9:33869
CONF-840853-	(International Society of Electrochemistry, Berkeley, CA, USA, 5-10 Aug 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009635	MN –94cc	9:33375
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009586	MN –94cc	9:33376
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012101	MN –93	9:33493
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012112	MN –94cc	9:33377
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012110	MN –94cb	9:33378
6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012107	MN –94ca	9:33379
CONF-840867-	(9. international protechnics seminar, Colorado Springs, CO, USA, 6-10 Aug 1984)			
1	*See* SAND-84-0143C	DE84012238	MN –45	9:34161
2	*See* SAND-84-0485C	DE84012903	MN –37	9:33866
3	*See* SAND-84-0459C	DE84013061	MN –45	9:34162
CONF-840868-	(9. international conference on raman, Toky· Japan, 26 Aug-1 Sep 1984)			
1	*See* SAND-84-1082C	DE84012240	MN –34	9:34574
CONF-840869-	(International conference on parallel processing, Bellaire, MI, USA, 21-24 Aug 1984)			
1	*See* LA-UR-84-1561	DE84012639	MN –32	9:34984
CONF-840870-	(Symposium on mathematics and computers in biomedical applications, Bethesda, MD, USA, 6-10 Aug 1984)			
1	*See* LA-UR-84-1688	DE84012446	MN –48	9:34385
CONF-840916-	(Robotics and remote handling in the nuclear industry conference, Toronto, Ontario, Canada, 23-27 Sep 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013417	MN –80	9:33053
CONF-8409104-	(59. annual Society of Petroleum Engineers of AIME technical conference, Houston, TX, USA, 16-19 Sep 1984)			
1	*See* SAND-84-0314C	DE84013808	MN –66b	9:32984
CONF-841058-	(Fall meeting of the Electrochemical Society, New Orleans, LA, US, 7-12 Oct 1984)			
2	*See* LBL-17776	DE84013235	MN -94c	9:33381
CONF-841201-	(ASME winter annual meeting, New Orleans, LA, USA, 9-13 Dec 1984)			
10	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013455	MN -38	9:33884
CONF-841219-	(5. intersociety cryogenics symposium, New Orlenas, LA, USA, 9-13 Dec 1984)			
1	*See* LA-UR-84-1490	DE84012623	MN -96	9:33546
COO-				
2982-103	*See* DOE/CS/40202-T11	DE84013271	MN -61D	9:32783
CSIRO-DAG-GCM-				
51	Commonwealth Scientific and Industrial Research Organization, Div. of Applied Geomechanics, Mount Waverley, Australia			9:32591
52	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia			9:32592
53	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia			9:32586
CSIRO-DAG-TR-				
40	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia			9:32593
41	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Australia			9:32594
CSIRO-DET-TR-				
2	Commonwealth Scientific and Industrial Research Organisation, Lucas Heights Research Labs., Sutherland, Australia			9:33469
CSIRO-DFF-IR-				
140	Commonwealth Scientific and Industrial Research Organization, Div. of Fossil Fuel, North Ryde, Australia			9:32443
CTOM-				
46983	Canadian Theses on Microfiche Service, National Library of Canada, Ottawa K1A 0N4		ND -38	9:33885

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CW-WR-				
78-036.65	*See* DOE/ET/12307-1431	DE84001061	STD -90e	9:33929
D-				
1	*See* PB-84-169085			9:32861
DESY-				
83-100	NTIS (US Sales Only), PC A03/MF A01	DE84751487	MN -34D	9:34589
83-106	NTIS (US Sales Only), PC A02/MF A01	DE84751428	MN -34D	9:34633
83-112	NTIS (US Sales Only), PC A02/MF A01	DE84751427	MN -34D	9:34634
83-113	NTIS (US Sales Only), PC A02/MF A01	DE84751426	MN -34D	9:34635
83-114	NTIS (US Sales Only), PC A02/MF A01	DE84751425	MN -34D	9:34590
83-115	NTIS (US Sales Only), PC A02/MF A01	DE84751483	MN -34D	9:34591
83-116	NTIS (US Sales Only), PC A02/MF A01	DE84751482	MN -34D	9:34644
83-117	NTIS (US Sales Only), PC A02/MF A01	DE84751481	MN -34D	9:34592
83-119	NTIS (US Sales Only), PC A02/MF A01	DE84751443	MN -34D	9:34593
83-120	NTIS (US Sales Only), PC A02/MF A01	DE84751486	MN -34D	9:34636
83-121	NTIS (US Sales Only), PC A03/MF A01	DE84751485	MN -34D	9:34594
83-122	NTIS (US Sales Only), PC A02/MF A01	DE84751484	MN -34D	9:34595
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283	NTIS (US Sales Only), PC A02/MF A01	DE84751488	MN -28	9:33975
284	NTIS (US Sales Only), PC A02/MF A01	DE84751489	MN -28	9:34015
285	NTIS (US Sales Only), PC A02/MF A01	DE84751490	MN -34D	9:34596
DFVLR-FB-				
84-03	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751770	MN -94a	9:33363
DLCS-				
5000483	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008164	MN -78	9:33069
DNA-				
8114-Rev.1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84012467	MN -41	9:34346
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13	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84012716	STD -92a	9:32650
DOE/BETC-				
83/ 4	NTIS, PC A04/MF A01 (GPO Dep.)	DE84012024	STD -92a	9:32651
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201	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013593	MN -11	9:34351
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257	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013662	MN -11	9:34178
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T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013287	MN -58c	9:32934
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T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013274	MN -59	9:32936
DOE/CS/32396-				
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T17	NTIS, PC A17/MF A01 (GPO Dep.)	DE84013093	STD -95f	9:32619
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T11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013271	MN -61D	9:32783
DOE/CS/40297-				
T1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84004840	STD -95f	9:33553
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DOE/CS/83104-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84012775	MN -59a	9:32947
DOE/EI/10691-				
T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013463	MN -98	9:33458
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0130(84/ 04)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE84013536	MN -98C	9:32678
0174(83)	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84013067	MN -98D	9:32948
0226(84/ 02)	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	DE84011591	MN -98E	9:33470
0226(84/ 03)	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013370	MN -98E	9:33471
0340-83/ 2	NTIS, PC A18/MF A01; 1 - GPO (GPO Dep.)	DE84013354	MN -98B	9:32660
0385	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	DE84012490	MN -98	9:33459
0489	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	DE84013669	MN -98C	9:32679
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0113/ 3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84011825	STD -20c	9:34842
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85	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013639	MN -4	9:33826

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DOE/ER/04471-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014121	MN -4	9:33773
DOE/ER/04471-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013499	MN -4	9:33774
DOE/ER/05223-68	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012971	MN -34C	9:34649
DOE/ER/05951-4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013467	MN -25	9:33631
DOE/ER/06035-6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012976	MN -4	9:33632
DOE/ER/10405-8	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013845	MN -34C	9:34722
DOE/ER/10416-5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013846	MN -34C	9:33738
DOE/ER/10444-10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013276	MN -34	9:34763
DOE/ER/10531-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013285	MN -63b	9:32846
DOE/ER/10641-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012949	MN -4	9:33819
DOE/ER/10641-3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013131	MN -4	9:33820
DOE/ER/10709-3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013451	MN -38	9:33916
DOE/ER/10845-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014218	MN -34	9:34145
DOE/ER/10846-T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84012940	MN -21	9:34843
DOE/ER/10897-3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013697	MN -25	9:33633
DOE/ER/10908-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013691	MN -25	9:33739
DOE/ER/10912-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013748	MN -4	9:33727
DOE/ER/10913-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010830	MN -25	9:34764
DOE/ER/12058-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013690	MN -4	9:32784
DOE/ER/13121-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013823	MN -32	9:34783
DOE/ER/13163-3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014097	MN -38	9:33850
DOE/ER/40001-T3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013270	MN -34A	9:34559
DOE/ER/40017-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014095	MN -34D	9:34016
DOE/ER/40048-23-N3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013843	MN -34C	9:34723
DOE/ER/40048-82-L3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013829	MN -34B	9:34524
DOE/ER/40048-83-L3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013830	MN -28	9:33942
DOE/ER/40048-88-L3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013824	MN -34C	9:34666
DOE/ER/40048-89-L3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013826	MN -34C	9:34113
DOE/ER/40048-91-L4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013773	MN -34A	9:34708
DOE/ER/40125-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012688	MN -34D	9:34598
DOE/ER/45022-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013642	MN -34A	9:34560
DOE/ER/45038-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013790	MN -25	9:33740
DOE/ER/45039-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012972	MN -34A	9:34561
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DOE/ER/70004-369	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013832	MN -34D	9:34610
DOE/ER/70004-376	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013751	MN -34C	9:34724
DOE/ET/10137-T8	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013199	STD -90d	9:32444
DOE/ET/10137-T10	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013525	STD -90d	9:32445
DOE/ET/10328-1628	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013151	STD -90c	9:32446
DOE/ET/10598-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013689	MN -90c	9:32607
DOE/ET/10633-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013670	MN -90c	9:32447
DOE/ET/12084-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013450	STD -92a	9:32652
DOE/ET/12307-1431	NTIS, PC A02/MF A01; 1	DE84001061	STD -90e	9:33929
DOE/ET/13046-T83	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84011682	MN -89	9:32448
DOE/ET/20630-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84012791	STD -63a	9:32902

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DOE/ET/27196-T17	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013636	MN -66	9:32967
DOE/ET/27252-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013595	MN -66	9:32968
T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013693	MN -66	9:32969
T3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013695	MN -66	9:32970
T4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013696	MN -66	9:32971
T5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013598	MN -66	9:32972
T6	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013596	MN -66	9:32973
T7	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013597	MN -66	9:32976
T8	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013694	MN -66	9:32974
DOE/ET/29008-1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84014168	MN -97c	9:33472
DOE/ET/29038-1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013140	MN -97	9:33018
DOE/ET/29362-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84014170	MN -97c	9:33473
DOE/ET/29364-1	NTIS, PC A08; 3 (GPO Dep.)	DE84013572	MN -97	9:33019
DOE/ET/29365-11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013320	MN -97	9:33024
DOE/ET/29367-1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84014165	MN -97	9:33474
DOE/ET/37210-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013484	MN -79p	9:33257
DOE/EV/10374-4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012712	MN -48	9:34297
DOE/EV/10396-T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013137	MN -11	9:33437
T2	NTIS, PC A19/MF A01 (GPO Dep.)	DE84013136	MN -11	9:33442
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DOE/EV/10662-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013275	MN -13	9:34975
DOE/EV/10750-T1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84012966	MN -11	9:34336
DOE/FC/10614-T4	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013290	STD -90b	9:32620
DOE/FE-0039	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013544	MN -92a	9:32661
DOE/FE/00016-T39	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012952	MN -88	9:32595
DOE/FE/15078-1613	NTIS, PC A04/MF A01 (GPO Dep.)	DE84012932	STD -93	9:33494
DOE/FE/60148-T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012969	MN -90	9:33042
DOE/FE/60181-23	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007671	MN -90i	9:32554
50	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013302	MN -90c	9:32555
58	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009231	MN -90a	9:32449
72	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010161	MN -90a	9:32450
81	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010164	MN -90	9:32451
85	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009700	MN -90	9:32452
DOE/ID/12026-T5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012701	STD -66a	9:32955
DOE/ID/12057-T8	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013412	STD -66a	9:32956
DOE/ID/12137-T1	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84013698	STD -66a	9:32988
DOE/ID/12201-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013685	STD -97e	9:32809
T3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013096	STD -97e	9:32840
DOE/IR/08323-T1	Society of American Florists, 901 N. Washington St., Alexandria, VA 22314	TI84009552	ND -95f	9:33513
DOE/JPL/955640-83	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013469	STD -63b	9:32847
DOE/JPL/956205-83/ 6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84004603	STD -63b	9:32848
DOE/JPL/956381-84/ 1	NTIS, PC A05/MF A01 (GPO Dep.)	DE84014177	STD -63b	9:32849
DOE/JPL/956698-84/ 2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013353	STD -63b	9:32850
DOE/LC/10350-1616	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84009254	STD -91	9:32685
DOE/LC/10977-1482	NTIS, PC A05/MF A01; 1	DE84000308	STD -90a	9:32453
DOE/MA-0155	NTIS, PC A04/MF A01 (GPO Dep.)	DE84012576	STD -13	9:34976
DOE/MC/10526-1609	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013652	STD -90c	9:32454
DOE/MC/14593-T9	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014086	MN -90c	9:32455
DOE/MC/19328-1320	NTIS, PC A06/MF A01; 1	DE83005060	STD -90e	9:33930

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DOE/MC/19403-1544	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84003083	STD -90a	9:32456
DOE/METC/SP-204	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84003098	STD -92	9:32675
206	NTIS, PC A03/MF A01 (GPO Dep.)	DE84003082	STD -90c	9:32492
DOE/NASA-1005-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011501	STD -96	9:33594
51040-55	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013537	STD -96	9:33595
DOE/NASA/0201-4	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013886	MN -97d	9:33495
DOE/NASA/50194-39	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013664	STD -96	9:33590
DOE/NBB-0024/ 1	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84013105	MN -13	9:34977
DOE/NBM-4013441	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013441	MN -11	9:34474
4013442	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013442	MN -11	9:34475
4013443	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013443	MN -11	9:34476
DOE/NE/93030-T1	NTIS, PC A09/MF A01 (GPO Dep.)	DE84013409	MN -70	9:32719
DOE/NV/10250-14	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012680	MN -70	9:32720
DOE/NV/10327-8	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE84013538	MN -41	9:34499
10	NTIS, PC A06/MF A01 (GPO Dep.)	DE84013139	MN -41	9:34169
DOE/OR/03054-12	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013163	STD -89	9:32493
20	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013974	STD -89	9:32494
24	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013521	STD -89	9:32495
25	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013782	STD -89	9:32496
29	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013645	STD -89	9:32497
30	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013522	STD -89	9:32498
31	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014151	STD -89	9:32499
32	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013791	STD -89	9:32500
49	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84013973	STD -89	9:32501
50-App.A-Vol.2	NTIS, PC A12/MF A01 (GPO Dep.)	DE84013325	STD -89	9:32502
50-App.B-Vol.2	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84013327	STD -89	9:32503
52	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013371	STD -89	9:32504
55	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84014061	STD -89	9:32505
58	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013792	STD -89	9:32506
62	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013976	STD -89	9:32507
91	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013977	STD -89	9:32508
96-Vol.1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84014117	STD -89	9:32509
96-Vol.2	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84014118	STD -89	9:32510
96-Vol.3	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84014119	STD -89	9:32511
100	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013634	STD -89	9:32512
101	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013560	STD -89	9:32513
107	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013780	STD -89	9:32514
DOE/OR/20722-16	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013663	MN -11	9:34298
DOE/OR/20890-2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013413	MN -95	9:33514
DOE/OR/21400-T21	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84012348	MN -32	9:35005
DOE/PC/30013-F9	NTIS, PC A05/MF A01 (GPO Dep.)	DE84012698	STD -90a	9:32545
DOE/PC/30019-T11	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84012293	STD -92a	9:32794
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DOE/PC/30217-T5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84012798	MN -90d	9:32515
DOE/PC/40268-T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013203	STD -90b	9:32621
DOE/PC/50001-15	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84004074	STD -90d	9:32516
DOE/PC/50041-37	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013174	STD -90d	9:32517
DOE/PC/50051-T4	NTIS, PC A08/MF A01; 1	DE84004620	STD -90d	9:32518
DOE/PC/50254-T7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013179	MN -90d	9:32622
DOE/PC/50786-7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008848	MN -90a	9:32519
DOE/PC/50793-T7	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84012796	STD -90d	9:32520
DOE/PC/60046-2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012288	STD -90d	9:32521
DOE/PC/60783-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006588	STD -90d	9:32522
DOE/PC/60791-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013178	MN -90a	9:32546
DOE/PC/60793-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008016	MN -90d	9:32523

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DOE/PC/60808-2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013317	STD -90d	9:32524
DOE/PC/60812-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012968	MN -90a	9:33813
DOE/PC/61256-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013632	STD -90a	9:32525
DOE/PE-0054-Exec.Summ.	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013785	MN -92	9:32681
DOE/PETC/TR-84/8	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014176	STD -90d	9:32526
DOE/R7/01142-T1	NTIS, PC A04; 3 (GPO Dep.)	DE84007855	MN -59b	9:32938
DOE/RA/08469-T1	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84008957	MN -90j	9:32636
DOE/RA/33008-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84012713	MN -92	9:33426
DOE/RA/50258-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84011443	MN -97c	9:33433
2	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013542	MN -97c	9:33434
DOE/RA/50259-1	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84013514	MN -97c	9:33427
DOE/RA/50327-1	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84013547	STD -95e	9:33579
DOE/RA/50418-1	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE84014162	MN -97	9:33475
DOE/RA/50419-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013658	MN -97	9:33020
DOE/RA/50420-1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013111	MN -32	9:34980
DOE/RC/11334-T1	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84013936	MN -98E	9:33476
DOE/RG/10063-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013293	MN -98E	9:33477
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013296	MN -98E	9:33585
T3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013297	MN -98E	9:33478
T4	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013292	MN -98E	9:33479
T5	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013294	MN -98E	9:33480
T6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013295	MN -98E	9:33481
DOE/RG/10409-T2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013309	MN -97	9:33021
DOE/RL/01830-T21	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014085	MN -90c	9:32527
DOE/SF/00034-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013466	MN -48	9:34380
DOE/SF/00515-T33	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013810	MN -28	9:34017
DOE/SF/11664-T3	NTIS, PC A; 3 (GPO Dep.)	DE84011396	STD -66f	9:32965
DOE/SR-84-SPP	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013158	MN -70	9:32721
DOE/SR/00001-T24	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013340	MN -70	9:32752
T25	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013358	MN -11	9:34331
T27	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013160	MN -11	9:32722
DOT-I-83-02	NTIS, PC A06/MF A01; 1	TI84901216	MN -96	9:33544
83-20	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84013590	MN -96	9:33545
DP-MS-82-32	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013818	MN -11	9:34515
83-126	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013168	MN -70	9:32723
84-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013364	MN -70B	9:32724
84-38	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013146	MN -11	9:34299
DP-tr-69	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013362	MN -4	9:32709
DPSP-61-25-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013152	MN -11	9:34300
62-25-1-Del.Ver.	NTIS, PC A02; 3 (GPO Dep.)	DE84013366	MN -11	9:34301
74-25-1	NTIS, PC A02; 3 (GPO Dep.)	DE84013169	MN -11	9:34302
DPSPU-83-124-1	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE84013504	MN -71	9:32710
84-30-1	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84013817	MN -11	9:34303
DPST-70-435	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013150	MN -11	9:34360
71-332	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013117	MN -11	9:34516
72-428	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013157	MN -12	9:33242
76-345-Del.Ver.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013165	MN -70	9:32725
78-545-Del.Ver.	NTIS, PC A03; 3 (GPO Dep.)	DE84013172	MN -80	9:33258
79-433	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013175	MN -70	9:32726
79-486-Del.Ver.	NTIS, PC A04; 3 (GPO Dep.)	DE84013173	MN -80	9:33259
79-548	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013166	MN -80	9:33260
80-351(DEL)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013171	MN -11	9:34304
80-445-Del.Ver.	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013176	MN -80	9:33243
82-808	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013155	MN -11	9:34352
83-829-Draft	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013156	MN -70	9:32753
83-829-Vol.1	NTIS, PC A22/MF A01; 1 (GPO Dep.)	DE84013347	MN -70	9:32754

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84-445	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013148	MN -11	9:34370
DREO-				
878	*See* AD-A-139015/2			9:34168
DREO-TN-				
83-34	*See* AD-A-139334/7			9:32670
DTH-ISVA-				
33	NTIS (US Sales Only), PC A11/MF A01; 1	DE84751000	MN -11	9:34508
DTH-ISVA-PR-				
57	NTIS (US Sales Only), PC A04/MF A01	DE84770195	MN -11	9:34353
DTH-LET-RE-				
83-6	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750995	MN -11	9:34224
EANSW-ESP-				
29	Energy Authority of New South Wales, Sydney, Australia			9:32637
EAS/E-				
3/ 81/ 3	*See* IEA/CREAS-84/08			9:32530
EAS-G-				
4	*See* IEA/CREAS-84/07			9:32639
ECN-				
83-174	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -90a	9:32547
83-179	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -90a	9:32548
83-181	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -60	9:32998
83-203	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands	TI84750916	ND -20	9:33860
138	NTIS (US Sales Only), PC A06/MF A01	DE84702051	MN -2	9:33225
140	NTIS (US Sales Only), PC A08/MF A01	DE84750911	MN -93	9:33490
141	NTIS (US Sales Only), PC A08/MF A01	DE84750912	MN -60	9:32999
ECS-SR-				
6	*See* DPST-84-445	DE84013148	MN -11	9:34370
EDF-				
82-H-338-449	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751584	MN -80	9:33152
EEB-W-				
84-03	*See* LBL-17476	DE84013389	MN -95d	9:33519
EGG-				
2313-Draft	*See* NUREG/CR-3781-Draft	DE84013534	MN -78	9:33328
10282-1011	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013548	STD -41	9:34305
10282-1034	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013485	STD -41	9:34306
10282-1038	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013489	STD -41	9:34307
EGG-M-				
11584	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012544	MN -34	9:33912
EGG-SCM-				
6567	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013086	MN -25	9:33814
EGG-TMI-				
6536	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013084	MN -85	9:33070
EIR-				
499	*See* KFK-3563			9:34945
500	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751281	MN -11	9:34330
EKONO-				
164	NTIS (US Sales Only), PC A02/MF A01	DE84751038	MN -13	9:33460
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418	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84014120	STD -11	9:34114
423	NTIS, PC A06/MF A01 (GPO Dep.)	DE84013758	STD -11	9:34225
428	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014122	STD -11	9:34115
EPA-				
450/ 3-82-023A	*See* PB-84-151448			9:34371
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520/ 5-83-024	*See* PB-84-166818			9:34315
560/ 5-83-024	*See* ORNL-6041	DE84013619	MN -11	9:34179
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EPRI-AP-				
3439	NTIS, PC A04/MF A01; 1 - EPRI (GPO Dep.)	DE84012732	MN -90d	9:32528
3498	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920408	ND -90d	9:32529
EPRI-CS-				
3182-Vol.1	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304	TI84920101	ND -11	9:34226
3343	EPRI-Research Reports Center, Box 50490, Palto Alto, CA 94303	TI84920275	ND -90i	9:34354
EPRI-EA-				
3507-Vol.1	NTIS, PC A03/MF A01 - EPRI (GPO Dep.)	DE84012078	MN -98E	9:33461
3507-Vol.2	NTIS, PC A07/MF A01 - EPRI (GPO Dep.)	DE84012080	MN -98E	9:33462
EPRI-EL-				
3391	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920318	ND -97d	9:33025
3505	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920413	ND -97a	9:33022
EPRI-NP-				
3275-Vol.1	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920391	ND -78	9:33071
3275-Vol.2	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920420	ND -78	9:33072
3347-SR	Electric Power Research Institute, Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920314	ND -80	9:33913
3461	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920390	ND -78	9:33075

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3473	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920375	ND -78	9:33261
3474	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920422	ND -78	9:33262
3483	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920383	ND -78	9:33634
3488	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920415	ND -78	9:33076
3489	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920417	ND -80	9:33120
3493	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920378	ND -78	9:33263
3513	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920385	ND -80	9:33264
3514	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920399	ND -78	9:33171
3519	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920381	ND -78	9:33265
3521	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920421	ND -78	9:33057
3538	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920419	ND -80	9:33026
EPS-				
3-WP-82-4	Environment Canada, Environmental Protection Service, Ottawa, Ontario			9:32559
ESC-WR-				
83-17	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -13	9:33428
83-24	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -95	9:33507
83-26	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -95f	9:33486
ESG-DOE-				
13432	*See* DOE/ET/10328-1628	DE84013151	STD -90c	9:32446
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8143-FR	*See* PB-84-163450			9:32856
8152-FR	*See* PB-84-164557			9:32905
8159-FR	*See* PB-84-163633			9:32858
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8481-FR	NTIS PC E04/MF E04			9:32989
8486	NTIS PC E20/MF E20			9:34444
8583-EN	Commission of the European Communities, Luxembourg			9:32957
8605-EN	NTIS PC E10/MF E10			9:32958
8790	Commission of the European Communities, Luxembourg	TI84751738	ND -66	9:32959
8791-EN	Commission of the European Communities, Luxembourg			9:32975
EUR-CEA-FC-				
1212	NTIS (US Sales Only), PC A02/MF A01; 1	DE84751586	MN -20	9:34793
FE-				
2247-34	*See* DOE/ET/10137-T10	DE84013525	STD -90d	9:32445
2247-35	*See* DOE/ET/10137-T8	DE84013199	STD -90d	9:32444
FERMILAB-Conf-				
84/ 29-THY	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012704	MN -34C	9:34107
84/ 40-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013083	MN -34B	9:34525
84/ 41-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012702	MN -34C	9:34638
84/ 48-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013082	MN -34D	9:34639
84/ 49-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013081	MN -34D	9:34599
FLT-				
3/ 1/ 80/ 82	*See* ISI-B-8-82	DE84751777	MN -95	9:33515
FRNC-TH-				
1320	NTIS (US Sales Only), PC A06; 3	DE84750801	MN -63	9:32851
1327	NTIS (US Sales Only), PC A06; 3	DE84750798	MN -92a	9:32667
1353	NTIS (US Sales Only), PC A06; 3	DE84751739	MN -59	9:32952
1363	NTIS (US Sales Only), PC A07; 3	DE84750800	MN -66	9:32977
1364	NTIS (US Sales Only), PC A08/MF A01	DE84751579	MN -21	9:34844
1404	NTIS (US Sales Only), PC A12/MF A01	DE84751581	MN -34D	9:34611
1404	NTIS (US Sales Only), PC A05/MF A01	DE84751581	MN -34C	9:34672
1427	NTIS (US Sales Only), PC A08/MF A01	DE84751582	MN -34A	9:34562
1430	NTIS (US Sales Only), PC A09/MF A01	DE84751561	MN -34D	9:34116
1459	NTIS (US Sales Only), PC A10/MF A01; 1	DE84751732	ND -94a	9:33364
1461	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751740	MN -92	9:32653
1512	NTIS (US Sales Only), PC A08; 3	DE84751737	MN -62c	9:32778
1517	NTIS (mf) (US Sales Only).; 2	DE84751736	MN -61E	9:32852
1525	NTIS (US Sales Only), PC A08/MF A01	DE84751560	MN -34D	9:34780
1526	NTIS (US Sales Only), PC A02/MF A01	DE84751583	MN -22	9:32697
1531	NTIS (US Sales Only), PC A05/MF A01	DE84751580	MN -34C	9:34667
1532	NTIS (US Sales Only), PC A08/MF A01	DE84751578	MN -34C	9:34688
1544	NTIS (US Sales Only), PC A12/MF A01	DE84751567	MN -34B	9:34526
1585	NTIS (US Sales Only), PC A06/MF A01	DE84751571	MN -41	9:34117
1586	NTIS (US Sales Only), PC A05/MF A01	DE84751551	MN -04	9:33833
1590	NTIS (US Sales Only), PC A09/MF A01	DE84751562	MN -34C	9:34709
FWS/OBS-				
84/ 08	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013134	STD -11	9:33439

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GA-A-				
17151	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013657	STD -20	9:34845
17377	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012961	MN -20d	9:34846
17378	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012958	MN -20b	9:34847
17379	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012962	MN -20a	9:34848
17380	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012963	MN -20d	9:34849
17495	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011154	MN -77	9:33117
17545	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013345	MN -38	9:33861
17555	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012571	MN -91	9:32654
17559	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013344	MN -77	9:33089
GC-TR-				
83-281	*See* AD-A-138791/9			9:33368
GEFR-				
00691	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84013566	STD -77	9:33118
GEND-				
035	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013866	STD -78	9:33266
040	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84014163	STD -78	9:33267
GJBX-				
4-84	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012792	MN -51	9:32693
GKSS-				
82/ E/ 56	NTIS (US Sales Only), PC A02/MF A01	DE84751430	MN -37	9:34118
83/ E/ 24	NTIS (US Sales Only), PC A02/MF A01; 1	DE84751288	MN -92a	9:33937
83/ E/ 53	NTIS (US Sales Only), PC A02/MF A01	DE84751444	MN -28	9:34745
83/ E/ 58	NTIS (US Sales Only), PC A04/MF A01	DE84751492	MN -80	9:33268
83/ E/ 59	NTIS (US Sales Only), PC A02/MF A01	DE84751493	MN -80	9:33269
GP-R-				
212106	*See* NUREG/CR-3606	DE84901384	MN -80	9:33212
GRS-A-				
840	*See* BMI-1983-012	DE84751499	MN -80	9:33210
841	*See* BMI-1983-009	DE84751500	MN -78	9:33066
872	*See* BMI-1983-025	DE84751432	MN -78	9:33067
GSF-S-				
708	NTIS (US Sales Only), PC A06/MF A01	DE84751441	MN -48	9:34397
956	NTIS (US Sales Only), PC A06/MF A01	DE84751477	MN -11	9:34308
960	NTIS (US Sales Only), PC A04/MF A01	DE84751502	MN -48	9:34445
GSI-				
82-15	NTIS (US Sales Only), PC A08/MF A01	DE84751439	MN -34C	9:33446
83-10	NTIS (US Sales Only), PC A03/MF A01	DE84751436	MN -28	9:33943
83-38-Prepr.	NTIS (US Sales Only), PC A03/MF A01	DE84751435	MN -34C	9:34725
84-1(Prepr.)	NTIS (US Sales Only), PC A03/MF A01	DE84751497	MN -34C	9:34726
84-2(Prepr.)	NTIS (US Sales Only), PC A02/MF A01	DE84751496	MN -34C	9:34727
HAR-				
4903	NTIS (US Sales Only), PC A03/MF A01	DE84780376	MN -37	9:34119
HEDL-				
7444	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013941	MN -25	9:33635
7451	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013942	MN -25	9:33636
HEDL-SA-				
3019-S	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013939	MN -79d	9:33094
3049	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006352	MN -79	9:33095
3056-S	NTIS, PC A02/MF A01	DE84007081	MN -79c	9:32700
HEDL-TME-				
83-23	*See* NUREG/CR-3391-Vol.3	DE84013503	MN -78	9:33177
HMI-B-				
380	Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik			9:34142
390	NTIS (US Sales Only), PC A03/MF A01	DE84751494	MN -25	9:33637
HMI-P-				
28/ 83-HF(Prepr.)	NTIS (US Sales Only), PC A03/MF A01	DE84751495	MN -34C	9:34704
HNEI-				
80-03	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84014845	MN -61D	9:32795
HRP-				
0904755/ 6	NTIS, PC A03/MF A01			9:34398
I-				
1	*See* PB-84-165455			9:33582
IAEA-R-				
2549-F	NTIS (US Sales Only), PC A03/MF A01	DE84702040	MN -37	9:34120
IEA/CREAS-				
84/ 07	NTIS PC $50.00			9:32639
84/ 08	NTIS PC $60.00			9:32530
IFP-				
31-115	NTIS (US Sales Only), PC A11/MF A01; 1	DE84750802	MN -92	9:32672
31-139	NTIS (US Sales Only), PC A11/MF A01; 1	DE84750799	MN -13	9:33466
31-431	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751733	ND -92a	9:32655
IKE-				
5-218	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751773	MN -94a	9:33365
INFO-				
0066(Rev.1)	NTIS (US Sales Only), PC A02/MF A01	DE84702047	MN -2	9:32694
INIS-BR-				
107	NTIS (US Sales Only), PC A10/MF A01	DE84780267	MN -34D	9:34521
108	NTIS (US Sales Only), PC A02/MF A01	DE84780336	MN -25	9:33645
115	NTIS (US Sales Only), PC A06/MF A01	DE84780352	MN -38	9:33851
116	NTIS (US Sales Only), PC A07/MF A01	DE84780350	MN -38	9:33886
117	NTIS (US Sales Only), PC A04/MF A01	DE84780334	MN -4	9:33776
118	NTIS (US Sales Only), PC A02/MF A01	DE84780340	MN -51	9:34510
119	NTIS (US Sales Only), PC A08/MF A01	DE84780333	MN -34C	9:34650

Report No.	*Availability*	*Order No.*	*Distribution Category*	*Abstract No.*
120	NTIS (US Sales Only), PC A11/MF A01	DE84780396	MN -2	9:33140
INIS-mf-				
8319	NTIS (US Sales Only), PC A07/MF A01	DE84780311	MN -22	9:32698
8325	NTIS (US Sales Only), PC A07/MF A01	DE84780316	MN -70	9:32727
8327	NTIS (US Sales Only), PC A05/MF A01	DE84780309	MN -48	9:34399
8328	NTIS (US Sales Only), PC A05/MF A01	DE84780303	MN -48	9:34400
8331	NTIS (US Sales Only), PC A02/MF A01	DE84780304	MN -48	9:34401
8332	NTIS (US Sales Only), PC A03/MF A01	DE84780312	MN -23	9:34402
8335	NTIS (US Sales Only), PC A08/MF A01	DE84780302	MN -41	9:34309
8338	NTIS (US Sales Only), PC A07/MF A01	DE84780314	MN -23	9:34403
8341	NTIS (US Sales Only), PC A06/MF A01	DE84780313	MN -23	9:34564
8345	NTIS (US Sales Only), PC A05/MF A01	DE84780326	MN -2	9:33282
8355	NTIS (US Sales Only), PC A04/MF A01	DE84780305	MN -48	9:34404
8356	NTIS (US Sales Only), PC A04/MF A01	DE84780307	MN -48	9:34391
8357	NTIS (US Sales Only), PC A06/MF A01	DE84780315	MN -37	9:34149
8358	NTIS (US Sales Only), PC A04/MF A01	DE84780310	MN -48	9:34405
8359	NTIS (US Sales Only), PC A05/MF A01	DE84780306	MN -48	9:34406
8368	NTIS (US Sales Only), PC A12/MF A01	DE84780317	MN -2	9:33450
8384	NTIS (US Sales Only), PC A07/MF A01	DE84780243	MN -48	9:34446
8389	NTIS (US Sales Only), PC A04/MF A01	DE84780256	MN -25	9:33652
8392	NTIS (US Sales Only), PC A06/MF A01	DE84780238	MN -34C	9:34660
8393	NTIS (US Sales Only), PC A06/MF A01	DE84780239	MN -34C	9:34682
8395	NTIS (US Sales Only), PC A02/MF A01	DE84780254	MN -71	9:33862
8706	NTIS (US Sales Only), PC A04/MF A01	DE84780246	MN -41	9:34448
8707	NTIS (US Sales Only), PC A06/MF A01	DE84780251	MN -48	9:34437
8709	NTIS (US Sales Only), PC A06/MF A01	DE84780252	MN -48	9:34410
8710	NTIS (US Sales Only), PC A03/MF A01	DE84780244	MN -23	9:34435
8711	NTIS (US Sales Only), PC A04/MF A01	DE84780249	MN -48	9:34411
8712	NTIS (US Sales Only), PC A03/MF A01	DE84780247	MN -41	9:34449
8713	NTIS (US Sales Only), PC A07/MF A01	DE84701931	MN -20	9:34802
8716	NTIS (US Sales Only), PC AXX/MF A01	DE84780248	MN -48	9:34412
8721	NTIS (US Sales Only), PC A08/MF A01	DE84780253	MN -48	9:34413
8722	NTIS (US Sales Only), PC A05/MF A01	DE84780250	MN -48	9:34414
8725	NTIS (US Sales Only), PC A05/MF A01	DE84780341	MN -48	9:34387
8726	NTIS (US Sales Only), PC A05/MF A01	DE84701930	MN -34A	9:34746
8734	NTIS (US Sales Only), PC A08/MF A01	DE84701932	MN -20	9:34803
8735	NTIS (US Sales Only), PC A07/MF A01	DE84780276	MN -34D	9:34600
8737	NTIS (US Sales Only), PC A06/MF A01	DE84780345	MN -23	9:34384
8738	NTIS (US Sales Only), PC A11/MF A01	DE84780330	MN -34D	9:34585
8743	NTIS (US Sales Only), PC A06/MF A01	DE84780347	MN -48	9:34441
8744	NTIS (US Sales Only), PC A07/MF A01	DE84780348	MN -48	9:34436
8747	NTIS (US Sales Only), PC A04/MF A01	DE84780346	MN -41	9:33283
8750	NTIS (US Sales Only), PC A05/MF A01	DE84780332	MN -34D	9:34601
8902	NTIS (US Sales Only), PC A05/MF A01	DE84780308	MN -48	9:34415
8903	NTIS, PC A11/MF A01	DE84780391	MN -20	9:34851
8904	NTIS (US Sales Only), PC A02/MF A01	DE84780324	MN -2	9:34759
8905	NTIS (US Sales Only), PC A02/MF A01	DE84780322	MN -2	9:33451
8909	NTIS (US Sales Only), PC A02/MF A01	DE84780318	MN -2	9:33467
8911	NTIS (US Sales Only), PC A02/MF A01	DE84780319	MN -2	9:33452
8912	NTIS (US Sales Only), PC A02/MF A01	DE84780320	MN -2	9:33468
8913	NTIS (US Sales Only), PC A02/MF A01	DE84780323	MN -2	9:33453
8915	NTIS (US Sales Only), PC A02/MF A01	DE84780325	MN -2	9:32766
8917	NTIS (US Sales Only), PC A02/MF A01	DE84780321	MN -2	9:34760
8918	NTIS (US Sales Only), PC A02/MF A01	DE84780377	MN -2	9:33221
8934	NTIS (US Sales Only), PC A18/MF A01	DE84780273	MN -34A	9:33664
8935	NTIS (US Sales Only), PC A99/MF A01	DE84780275	MN -34B	9:34586
8941	NTIS (US Sales Only), PC A03/MF A01	DE84780338	MN -51	9:34517
8942	NTIS (US Sales Only), PC A05/MF A01	DE84780388	MN -34A	9:33665
8943	NTIS (US Sales Only), PC A07/MF A01	DE84780342	MN -48	9:34455
8945	NTIS (US Sales Only), PC A05/MF A01	DE84780335	MN -4	9:33799
8946	NTIS (US Sales Only), PC A06/MF A01	DE84780389	MN -34A	9:33749
8947	NTIS (US Sales Only), PC A06/MF A01	DE84780343	MN -48	9:34456
8948	NTIS (US Sales Only), PC A07/MF A01	DE84780344	MN -48	9:34477
8950	NTIS (US Sales Only), PC A05/MF A01	DE84780339	MN -51	9:34518
8952	NTIS (US Sales Only), PC A06/MF A01	DE84780337	MN -25	9:33750
8953	NTIS (US Sales Only), PC A07/MF A01	DE84780331	MN -34D	9:34619
8956	NTIS (US Sales Only), PC A08/MF A01	DE84780390	MN -34A	9:33800
8957	NTIS (US Sales Only), PC A09/MF A01	DE84780392	MN -20	9:34804
8959	NTIS (US Sales Only), PC A07/MF A01	DE84780393	MN -20	9:34805
8960	NTIS (US Sales Only), PC A06/MF A01	DE84780394	MN -20	9:34806
8973	NTIS (US Sales Only), PC A06/MF A01	DE84780349	MN -23	9:33801
8974	NTIS (US Sales Only), PC A03/MF A01	DE84702052	MN -2	9:33119
8975	NTIS (US Sales Only), PC A02/MF A01	DE84702046	MN -70	9:32728
8976	NTIS (US Sales Only), PC A05/MF A01	DE84702049	MN -2	9:33233
INIS-SU-				
202	NTIS (US Sales Only), PC A23/MF A01	DE84780274	MN -20	9:34910
221	NTIS (US Sales Only), PC A06/MF A01	DE84780353	MN -28	9:33962
222	NTIS (US Sales Only), PC A06/MF A01	DE84780272	MN -34A	9:33670
223	NTIS (US Sales Only), PC A06/MF A01	DE84780351	MN -38	9:33964
INS-TL-				
143	NTIS (US Sales Only), PC A02/MF A01	DE84702041	MN -37	9:34131
IPP-				
2/ 252	NTIS (US Sales Only), PC A04/MF A01	DE84751431	MN -20	9:34816
IS-M-				
462	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012135	MN -90d	9:32608

Report No.	Availability	Order No.	Distribution Category	Abstract No.
473	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012309	MN -4	9:33821
475	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014128	MN -80	9:33288
476	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014126	MN -4	9:33804
480	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014123	MN -34	9:33671
486	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013730	MN -80	9:33289
488	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013729	MN -25	9:33915
489	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013727	MN -80	9:33290
491	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014125	MN -4	9:33816
IS-T-				
1095	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013912	MN -90a	9:32562
1106	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84013981	MN -4	9:33822
1140	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013983	MN -25	9:33672
ISI-B-				
8-82	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751777	MN -95	9:33515
ISPO-				
199	*See* LA-9902-MS	DE84014132	STD -15	9:32768
JAERI-M-				
83-050	NTIS (US Sales Only), PC A03/MF A01	DE84702036	MN -79	9:33111
83-056	NTIS (US Sales Only), PC A04/MF A01	DE84702048	MN -32	9:33061
Juel-				
1865	*See* KFK-3439	DE84751440	MN -86	9:32706
1868	NTIS (US Sales Only), PC A07/MF A01	DE84751498	MN -48	9:34457
Juel-Spez-				
202	Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik			9:34652
203	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751418	MN -60	9:33000
224	NTIS (US Sales Only), PC A06/MF A01; 1	DE84751283	MN -11	9:34337
K/CSD/TM-				
52	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013576	MN -32	9:33864
K/ET-				
235	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012756	MN -4	9:33876
K/OA-				
5672	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012801	MN -4	9:32699
KFK-				
3063-Suppl.1	NTIS (US Sales Only), PC A05/MF A01	DE84751450	MN -32	9:34646
3439	NTIS (US Sales Only), PC A03/MF A01	DE84751440	MN -86	9:32706
3560	NTIS (US Sales Only), PC A04/MF A01	DE84751451	MN -79	9:33294
3563	Special print from Atomenerg. Kerntech. (1983) v. 43(3) p. 198-202			9:34945
3566	NTIS (US Sales Only), PC A03/MF A01	DE84751438	MN -11	9:34310
3596	NTIS (US Sales Only), PC A05/MF A01	DE84751480	MN -37	9:34132
3611	NTIS (US Sales Only), PC A06/MF A01; 1	DE84751287	MN -11	9:34355
3612	NTIS (US Sales Only), PC A04/MF A01	DE84751491	MN -70	9:32729
3619	NTIS (US Sales Only), PC A08/MF A01	DE84751446	MN -83	9:32701
3628	NTIS (US Sales Only), PC A03/MF A01	DE84751445	MN -25	9:33673
3637	NTIS (US Sales Only), PC A02/MF A01	DE84751501	MN -70	9:32707
3639	NTIS (US Sales Only), PC A04/MF A01	DE84751437	MN -04	9:33832
3641	NTIS (US Sales Only), PC A03/MF A01	DE84751442	MN -38	9:33904
3642	NTIS (US Sales Only), PC A03/MF A01	DE84751449	MN -34C	9:34678
3643	NTIS (US Sales Only), PC A02/MF A01	DE84751448	MN -34D	9:34603
3651	NTIS (US Sales Only), PC A04/MF A01	DE84751447	MN -25	9:33674
3658	Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)			9:33087
KTM/E-D-				
19	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751037	MN -95d	9:33516
KURRI-TR-				
224	NTIS (US Sales Only), PC A04/MF A01	DE84702037	MN -80	9:33244
228	NTIS (US Sales Only), PC A05/MF A01	DE84702038	MN -80	9:33245
KY-				
742	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012711	MN -11	9:34311
LA-				
8862-MS-Rev.2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014141	STD -38	9:33918
9680-SR	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014173	STD -33A	9:32774
9850-M	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014133	STD -15	9:32767
9893-MS	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013855	STD -41	9:34458
9902-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014132	STD -15	9:32768
9917-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013852	STD -32	9:34981
9998-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014146	STD -34	9:34555
10005	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014129	STD -32	9:34982
10020-MS	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013858	STD -20f	9:34817
10029-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013861	STD -20g	9:34818
10036-PR	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014142	STD -79b	9:33112
10039-MS	*See* NUREG/CR-3704	DE84013530	MN -78	9:33327
10051-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014138	STD -28	9:34094
10061-SR	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014143	STD -10	9:33805
10064-T	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84013875	STD -34C	9:34665
10065-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013860	STD -34	9:34819
10067-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013853	STD -66b	9:32960
10075-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013918	STD -23	9:32775
10078-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014137	STD -80	9:34501
10084-MS-Vol.1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014139	STD -20	9:34820
10086-MS	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013876	STD -11	9:34228
10092-T	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013874	STD -32	9:34748
10095-MS	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013856	STD -11	9:34229
10100-ENV	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013933	STD -41	9:34312

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10105-OBES	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013857	STD -66b	9:32961
LA-tr-				
84-13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013351	MN -11	9:34296
84-21	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013368	MN -4	9:33714
LA-UR-				
83-2489	NTIS, PC A02/MF A01 (GPO Dep.)	DE83017313	MN -34B	9:33756
83-3658	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84004415	MN -78	9:33295
84-166	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006016	MN -38	9:33905
84-430	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84011404	MN -13	9:34556
84-499	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007504	MN -59c	9:32939
84-889	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010068	MN -25	9:33675
84-904	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010076	MN -34	9:34580
84-905	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010072	MN -34	9:34581
84-924	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009969	MN -11	9:34519
84-944	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009972	MN -34	9:34582
84-1017	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009979	MN -25	9:33757
84-1019	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009980	MN -25	9:33676
84-1020	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009984	MN -34	9:34583
84-1041	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009987	MN -4	9:33817
84-1051	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009990	MN -34	9:33677
84-1052	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009985	MN -34	9:34584
84-1053	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009991	MN -25	9:33678
84-1088	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009995	MN -34	9:34565
84-1106	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010002	MN -66a	9:32978
84-1189	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84012292	MN -38	9:33906
84-1193	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011350	MN -66b	9:32979
84-1202	NTIS, PC A02; 3 (GPO Dep.)	DE84011413	MN -25	9:33758
84-1203	NTIS, PC A02; 3 (GPO Dep.)	DE84011333	MN -25	9:33679
84-1480	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012641	MN -80	9:33114
84-1490	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012623	MN -96	9:33546
84-1499	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012626	MN -32	9:34983
84-1525	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012634	MN -34	9:33710
84-1561	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012639	MN -32	9:34984
84-1583	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012438	MN -32	9:34985
84-1586	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012439	MN -78	9:33296
84-1595	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012435	MN -34B	9:34549
84-1639	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012452	MN -66b	9:32962
84-1676	NTIS, PC A02; 3 (GPO Dep.)	DE84012445	MN -32	9:34986
84-1688	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012446	MN -48	9:34385
84-1704	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012580	MN -38	9:33907
84-1717	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012582	MN -32	9:34784
84-1721	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012585	MN -78	9:33297
84-1796	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013894	MN -48	9:34431
84-1849	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013899	MN -34D	9:34738
84-1855	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013900	MN -34C	9:34739
84-1871	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013901	MN -34D	9:34657
84-1872	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013902	MN -34D	9:34740
84-1873	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013903	MN -34D	9:34741
84-1900	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013906	MN -66b	9:32980
84-1959	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014035	MN -15	9:32769
84-1962	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014036	MN -37	9:33919
84-1990	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014031	MN -90c	9:32531
84-2027	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014025	MN -34D	9:34742
LAL-				
83-26	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751564	MN -34D	9:34620
LAL-RT-				
83-14	NTIS (US Sales Only), PC A02/MF A01; 1	DE84751565	MN -37	9:34133
LALP-				
82-9(6/ 82)	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012992	MN -32	9:34987
83-9(5-83)	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84011736	MN -32	9:34988
84-13(3-84)	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84011742	MN -32	9:34989
84-14	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014135	MN -2	9:34990
LAPP-TH-				
89	*See* DESY-83-106	DE84751428	MN -34D	9:34633
LBL-				
14511	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013244	MN -66b	9:32981
14957	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013393	MN -59	9:32953
15050	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013859	MN -70	9:32755
15701	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013392	MN -11	9:34356
16604	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013242	MN -25	9:33806
16659	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013878	STD -11	9:34230
16890	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013879	STD -34A	9:34946
17068	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013394	MN -28	9:34095
17149	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013398	MN -48	9:34459
17196	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013882	STD -95d	9:33517
17220	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012257	MN -4	9:33845
17222	NTIS, PC A03/MF A01 (GPO Dep.)	DE84006771	MN -4	9:33846
17237	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013390	MN -25	9:33680
17274	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006755	MN -11	9:34231
17444	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013884	STD -95d	9:33518
17476	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013389	MN -95d	9:33519
17622	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013881	STD -41	9:34313
17644	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012251	MN -66a	9:32963
17649	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014136	STD -62	9:32842
17670	NTIS, PC A03/MF A01 (GPO Dep.)	DE84011442	MN -34A	9:34566

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17671	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013883	STD -90d	9:32532
17694	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012252	MN -66a	9:32982
17709	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013880	STD -32	9:34991
17719	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013237	MN -28	9:33965
17742	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013877	STD -94c	9:33380
17745	NTIS, PC A10/MF A01; 1	DE84013399	MN -70	9:32730
17768	NTIS, PC A08/MF A01 (GPO Dep.)	DE84013238	MN -48	9:34382
17776	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013235	MN -94c	9:33381
17806	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013241	MN -34D	9:34604
17822	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013240	MN -4	9:34567
17825	NTIS, PC A07/MF A01 (GPO Dep.)	DE84013243	MN -34	9:33759
17826	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84013401	MN -48	9:34440
17837	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013247	MN -34C	9:34743
17840	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013246	MN -34	9:34782
17845	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013236	MN -34D	9:34605
MBL-				
1982-15	*See* PB-84-164037			9:34427
MIT/EL-				
83-007	*See* PB-84-169754			9:33329
84-001	*See* PB-84-169606			9:33141
84-006	NTIS, PC A04/MF A01 (GPO Dep.)	DE84012737	MN -97d	9:33038
MLM-				
3150	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013629	STD -4	9:34971
3151	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013541	STD -90a	9:32549
3157	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013675	STD -4	9:34160
3158(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013280	MN -90d	9:32533
MPI-PAE/Exp.El.-				
120	NTIS (US Sales Only), PC A05/MF A01	DE84751424	MN -34D	9:34621
MPQ-				
79	Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)			9:34947
80	Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)			9:34948
MST-LUFT-A-				
73	NTIS (US Sales Only), PC A08/MF A01; 1	DE84751004	MN -11	9:34232
N-				
8418322	NTIS, PC A03/MF A01			9:34568
8418401	NTIS, PC A03/MF A01			9:33760
8418575	NTIS, PC A02/MF A01			9:33865
8418622	NTIS, PC A10/MF A01			9:33877
8419468	NTIS, PC A06/MF A01			9:34569
8419495	NTIS, PC A03/MF A01			9:33931
8419844	SVIC, Code 5804, Naval Research Lab.,;Washington, D.C. 20375			9:33048
NASA/CR-				
3338-Vol.1	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84012300	MN -63	9:32903
168172	*See* N-8418322			9:34568
168298	*See* DOE/NASA/0201-4	DE84013886	MN -97d	9:33495
173305	*See* N-8418575			9:33865
173364	*See* N-8418401			9:33760
174621	*See* N-8419468			9:34569
175396	*See* N-8419495			9:33931
NASA-TM-				
83627	*See* DOE/NASA/50194-39	DE84013664	STD -96	9:33590
83650	*See* DOE/NASA-1005-3	DE84011501	STD -96	9:33594
83676	*See* DOE/NASA-51040-55	DE84013537	STD -96	9:33595
NBL-				
311	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013668	MN -15	9:32770
NBS-BSS-				
159	*See* PB-84-160993			9:34153
NBSIR-				
84-2808(FDA)	*See* PB-84-175538			9:33730
84-2816	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013414	MN -38	9:33520
84-2867	*See* DOE/OR/20890-2	DE84013413	MN -95	9:33514
NCB-YRL-				
16418	National Coal Board, Yorkshire Regional Lab., Rotherham, England			9:32609
16434	National Coal Board, Yorkshire Regional Lab., Rotherham, England			9:32610
16443	National Coal Board, Yorkshire Regional Lab., Rotherham, England			9:32611
NCEL-TN-				
1679	*See* AD-A-139457/6			9:33587
1686	*See* AD-A-140085/2			9:33550
NDL-				
41-VI	*See* PB-84-163245			9:33548
NE-				
1983-6	NTIS (US Sales Only), PC A12/MF A01; 1	DE84751009	MN -61A	9:32853
1983-8	NTIS (US Sales Only), PC A05/MF A01; 1	DE84751008	MN -13	9:33488
1983-9	NTIS (US Sales Only), PC A03/MF A01	DE84751010	MN -61A	9:32854
1983-18	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751006	MN -61	9:32855
1983-19	NTIS (US Sales Only), PC A17/MF A01; 1	DE84751007	MN -95f	9:33039
NE/BF-				
82-17	NTIS (US Sales Only), MF A01; 2	DE84751014	MN -61F	9:32534

Report No.	Availability	Order No.	Distribution Category	Abstract No.
NE-F-				
3-42-6-84	Nuclear Standards Management Center, P.O. Box Y, Oak Ridge, TN 37831	TI84013306	STD -80	9:34502
3-43-6-84	NSMC-ORNL, Box Y, Oak Ridge, TN 37830	TI84013308	STD -80	9:34503
3-44-6-84	NSMC-ORNL, Box Y, Oak Ridge, TN 37830	TI84013307	STD -80	9:34504
NE/FBA-				
83-17	NTIS (US Sales Only), PC A10/MF A01; 1	DE84751018	MN -11	9:33939
NE-M-				
17-1T-6-84	Nuclear Standards Management Center-ORNL, P.O. Box Y, Oak Ridge, TN 37831	TI84013988	STD -79Tp	9:34505
NE/VIND-				
83-16	NTIS (US Sales Only), PC A09/MF A01; 1	DE84751013	MN -60	9:32994
83-17	NTIS (US Sales Only), PC A02/MF A01; 1	DE84751012	MN -60	9:32995
NEAC-				
19	Australian Government Publishing Service, Canberra			9:33040
NNC-				
01	NTIS (US Sales Only), PC A03/MF A01	DE84702035	MN -78	9:33088
NP-				
4750996	NTIS (US Sales Only), PC A03/MF A01; 1	DE84750996	MN -90b	9:32612
4750997	NTIS (US Sales Only), PC A07/MF A01; 1	DE84750997	MN -90b	9:32613
4750998	NTIS (US Sales Only), PC A06/MF A01	DE84750998	MN -90b	9:32614
4750999	NTIS (US Sales Only), MF A01; 2	DE84750999	MN -92a	9:32656
4770196	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770196	MN -88	9:32640
4770264	NTIS (US Sales Only), PC A13/MF A01; 1	DE84770264	MN -96	9:33600
4770266	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770266	MN -13	9:33482
4770267	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770267	MN -97	9:33049
4770268	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770268	MN -97	9:33050
4770269	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770269	MN -4	9:32796
4770323	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770323	MN -13	9:33424
4770324	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770324	MN -13	9:33425
4770325	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770325	MN -11	9:34478
4770326	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770326	MN -11	9:34479
4770327	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770327	MN -59a	9:32940
4770328	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770328	MN -95d	9:33761
4770329	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770329	MN -95d	9:33521
4770330	NTIS (US Sales Only), PC A16/MF A01; 1	DE84770330	MN -11	9:34374
4770332	NTIS (US Sales Only), PC A04/MF A01; 1	DE84770332	MN -48	9:34480
4770333	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770333	MN -13	9:33936
4901132	NTIS (US Sales Only), PC A02/MF A01	DE84901132	MN -60	9:32992
4901204	NTIS, PC A03/MF A01; 1	DE84901204	MN -95d	9:33522
4901417	NTIS (US Sales Only), PC A02/MF A01	DE84901417	MN -60	9:33006
NPS-				
67-83-003CR	*See* AD-A-139961/7			9:33928
NRL-MR-				
5224	*See* AD-A-137317/4			9:33873
5225	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013291	MN -21	9:34949
5243	*See* AD-A-137122/8			9:34788
NTNF/B-				
1840.08733	NTIS (US Sales Only), PC A03/MF A01	DE84751023	MN -92b	9:32673
NUREG-				
0020-Vol.8-No.4	NTIS, PC A18/MF A01; 1 - GPO*	DE84901261	MN -80	9:33062
0090-Vol.6-No.4	NTIS, PC A03/MF A01; 1 - GPO*	DE84901383	MN -80	9:33298
0748-Vol.4-No.4	NTIS, PC A17/MF A01 - GPO*	DE84901370	MN -80	9:33115
0776-Suppl.7	NTIS, PC A02/MF A01 - GPO* $3.00	DE84901262	MN -78	9:33299
0853-Suppl.3	NTIS, PC A03/MF A01 - GPO* $4.00	DE84901263	MN -78	9:33300
1062	NTIS, PC A10/MF A01; 1 - GPO* $6.50	DE84901375	MN -78	9:33301
NUREG/BR-				
0051-Vol.5-No.6	NTIS, PC A03/MF A01 - GPO*	DE84901373	MN -80	9:33302
NUREG/CP-				
0048-Vol.5	NTIS MF A01; 2 - GPO* $8.00	DE84900649	MN -78	9:33303
NUREG/CR-				
2424-Vol.1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013535	MN -11	9:34361
2424-Vol.2	NTIS, PC A05/MF A01; 1 - GPO $4.50 (GPO Dep.)	DE84013759	MN -11	9:34362
3310	NTIS, PC A17/MF A01; 1 - GPO (GPO Dep.)	DE84013500	MN -80	9:33322
3316	NTIS, PC A08/MF A01; 1 - GPO $6.50 (GPO Dep.)	DE84013760	MN -70	9:32756
3366	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84013532	MN -80	9:33323
3378	NTIS, PC A03/MF A01; 1 - GPO $4.00 (GPO Dep.)	DE84012304	MN -70	9:32757
3391-Vol.3	NTIS, PC A09/MF A01; 1 - GPO $6.00 (GPO Dep.)	DE84013503	MN -78	9:33177
3391-Vol.4	NTIS, PC A05/MF A01; 1 - GPO $4.50	DE84014091	MN -78	9:33178
3476	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84013533	MN -11	9:34357
3489	NTIS, PC A99/MF A01; 1 - GPO $11.00	DE84901376	MN -70	9:32731
3523	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	DE84008011	MN -80	9:33063
3566	NTIS, PC A09/MF A01; 1 - GPO $6.00 (GPO Dep.)	DE84013356	MN -41	9:33324
3588	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84013527	MN -80	9:33325
3590	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84013641	MN -48	9:34460
3600	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84012858	MN -78	9:33064
3606	NTIS, PC A07/MF A01; 1 - GPO* $5.50	DE84901384	MN -80	9:33212
3613	NTIS, PC A04/MF A01; 1 - GPO $4.50 (GPO Dep.)	DE84013756	MN -78	9:33065
3618	NTIS, PC A05/MF A01 - GPO (GPO Dep.)	DE84013064	MN -78	9:33326
3630	NTIS, PC A09/MF A01; 1 - GPO (GPO Dep.)	DE84012931	MN -78	9:33179
3671	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84013925	MN -78	9:33180
3686-Vol.1	NTIS, PC A12/MF A01; 1 - GPO (GPO Dep.)	DE84007415	MN -32	9:34992
3686-Vol.2	NTIS, PC A10/MF A01 (GPO Dep.)	DE84007416	MN -32	9:34993
3686-Vol.4	NTIS, PC A12/MF A01; 1 - GPO (GPO Dep.)	DE84007403	MN -32	9:33852
3704	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84013530	MN -78	9:33327

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3759	NTIS, PC A03/MF A01 - GPO* $4.00	DE84901264	MN -80	9:34176
3773	NTIS, PC A04/MF A01; 1 - GPO $4.00	DE84901286	MN -11	9:34233
3781-Draft	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	DE84013534	MN -78	9:33328
OEFZS-				
4266	Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.			9:33041
OITS-				
209	*See* DOE/ER/70004-369	DE84013832	MN -34D	9:34610
219	*See* DOE/ER/70004-363	DE84013753	MN -34	9:34645
ORAU/IEA-				
84-4(M)	NTIS, PC A02/MF A01 (GPO Dep.)	DE84012674	MN -2	9:33454
ORNL-				
5941	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013577	MN -41	9:33455
5981	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014172	STD -41	9:34461
5991	*See* NUREG/CR-3618	DE84013064	MN -78	9:33326
6035	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013519	MN -11	9:34481
6041	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84013619	MN -11	9:34179
6042	NTIS, PC A09/MF A01 (GPO Dep.)	DE84013482	STD -2	9:33429
6047	*See* NUREG/CR-3671	DE84013925	MN -78	9:33180
6050	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013766	MN -13	9:33487
6052	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013574	MN -34A	9:34570
6058	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013569	STD -79d	9:33234
6061	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84013765	STD -70B	9:32758
ORNL/CDIC-				
1/ R1	NTIS, PC A12/MF A01 (GPO Dep.)	DE84013683	MN -11	9:34234
ORNL/CON-				
152	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014421	MN -95d	9:33580
154	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013493	MN -95c	9:33596
159	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013132	STD -95d	9:33523
ORNL/PPA-				
84/ 2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013549	MN -13	9:34972
ORNL/SGMP-				
84/ 1	NTIS, PC A07/MF A01 (GPO Dep.)	DE84013492	MN -90c	9:32535
ORNL/Sub-				
81-7762/ 301	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013568	STD -95d	9:33524
ORNL/TM-				
8621	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013771	MN -32	9:35006
8669	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013133	MN -28	9:33966
8682	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013605	STD -41	9:34363
8724	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013625	STD -97a	9:33051
8880	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013594	MN -32	9:34003
8901	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013106	STD -70	9:32732
8922	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013626	STD -77	9:33090
8948	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014096	STD -86	9:32708
8950	*See* NUREG/CR-3523	DE84008011	MN -80	9:33063
8976	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013624	MN -20d	9:34950
9003	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013113	STD -70	9:32733
9006	*See* NUREG/CR-3590	DE84013641	MN -48	9:34460
9011	*See* NUREG/CR-3600	DE84012858	MN -78	9:33064
9014	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013622	MN -70	9:32734
9015	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013601	STD -20a	9:34821
9032	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013772	MN -34	9:34571
9065	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013665	MN -13	9:33463
9072	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013129	STD -95d	9:33554
9075	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013627	STD -20f	9:34822
9112	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013109	STD -37	9:34152
9123	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013573	MN -34C	9:34749
9127	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013600	STD -20	9:34823
9133	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013602	STD -20	9:34824
9136	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013623	MN -32	9:34978
9169	NTIS, PC A05/MF A01 (GPO Dep.)	DE84013770	STD -48	9:34482
9195	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013769	STD -48	9:34483
9196	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013112	STD -4	9:32674
9203	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013603	STD -20d	9:34951
9205	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012706	MN -80	9:33235
9213	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013767	STD -13	9:33920
9214	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013480	MN -80	9:33236
9222	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012667	MN -80	9:33246
9232	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013130	MN -32	9:35007
ORNL-tr-				
5120	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010369	MN -4	9:33735
5125	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012869	MN -22	9:33810
5130	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012988	MN -20a	9:34970
ORO-				
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84-145531	NTIS PC E06/MF E06			9:34364
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84-163724	NTIS, PC A20/MF A01			9:34485
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84-165661	NTIS PC E04/MF E04			9:32906
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84-169705	NTIS PC E03/MF E03			9:34394
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84-171412	NTIS PC E11/MF E11			9:33532
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84-171586	NTIS PC E05/MF E05			9:33534
84-171594	NTIS PC E04/MF E04			9:33566
84-171602	NTIS PC E06/MF E06			9:33535
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PLG-				
0300	*See* PB-84-186949			9:33331
PNL-				
3777-Rev.1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013510	MN -41	9:34317
4726	NTIS, PC A05/MF A01 (GPO Dep.)	DE84014130	MN -85	9:32711
4911	*See* NUREG/CR-3566	DE84013356	MN -41	9:33324
4941	*See* NUREG/CR-3613	DE84013756	MN -78	9:33065
5067	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013854	MN -94e	9:33366
5088-1-Vol.1	*See* NUREG/CR-2424-Vol.1	DE84013535	MN -11	9:34361
5088-1-Vol.2	*See* NUREG/CR-2424-Vol.2	DE84013759	MN -11	9:34362
5089	NTIS, PC A06/MF A01 (GPO Dep.)	DE84013515	MN -85	9:32712
5127	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013628	MN -94e	9:33367
5136	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013922	MN -32	9:34135
PNL-SA-				
10915	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013254	MN -41	9:32761
10985	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013252	MN -41	9:34136
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11448	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013264	MN -61D	9:32789
12032	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008314	MN -4	9:33809
12095	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013250	MN -32	9:34785
12117	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013261	MN -11	9:34244
12126	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013405	MN -70	9:32736
12129	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013404	MN -11	9:34334
12161	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013256	MN -32	9:34994
12234	NTIS, PC A09/MF A01 (GPO Dep.)	DE84013410	MN -59	9:33540
12244	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013267	MN -60	9:33008
12245	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013269	MN -60	9:33009
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12284	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013248	MN -70B	9:32759
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12342	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013265	MN -90c	9:32536
PPPL-				
2106	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013100	STD -20	9:34825
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3	*See* PB-84-171925			9:32668
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66/ 83	*See* KFK-3639	DE84751437	MN -04	9:33832
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26-79	*See* PB-84-158724			9:32563
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RD/B/N-				
1500	NTIS (US Sales Only), PC A03/MF A01; 1	DE84901356	MN -77	9:33091
RFP-				
3638	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013916	STD -60	9:33010
3678	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013620	STD -60	9:33011
RFP-Trans-				
421	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013911	MN -47	9:32695
RHO-BW-SA-				
311-P	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013200	MN -70	9:32738
RISO-M-				
2400	NTIS (US Sales Only), PC A03/MF A01; 1	DE84751005	MN -60	9:33012
RL-				
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RTI-				
1914-70-01F	*See* PB-84-179878			9:33539
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84/ 1628-PRI-79	NTIS, PC A03/MF A01 (GPO Dep.)	DE84012675	STD -20g	9:34829
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82-1977	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013630	MN -70	9:32739
83-0372	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013650	STD -70	9:32740
83-1149	*See* NUREG/CR-3310	DE84013500	MN -80	9:33322
83-1154	*See* NUREG/CR-3316	DE84013760	MN -70	9:32756
83-1350	*See* NUREG/CR-3366	DE84013532	MN -80	9:33323
83-1466	*See* NUREG/CR-3378	DE84012304	MN -70	9:32757
83-1809	NTIS, PC A03/MF A01 (GPO Dep.)	DE84013310	MN -34A	9:34572
83-1889	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013147	MN -32	9:33854
83-2273C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012812	MN -94cb	9:33385
83-2330C	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007343	MN -4	9:33332
83-2332C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013056	MN -25	9:33614

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83-2358C	NTIS PC A02/MF A01	DE84002612	MN -38	9:33908
83-2375C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84011681	MN -63	9:32862
83-2393C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006104	MN -80	9:33333
83-2406	*See* NUREG/CR-3588	DE84013527	MN -80	9:33325
83-2434C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013126	MN -38	9:33921
83-2496C	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006964	MN -32	9:34995
83-2603	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013483	STD -91	9:32686
83-2629C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84012277	MN -20c	9:34953
83-2652	*See* NUREG/CR-3630	DE84012931	MN -78	9:33179
83-2654C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013060	MN -78	9:33334
83-7018	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84013631	MN -63	9:32907
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UY Uruguay

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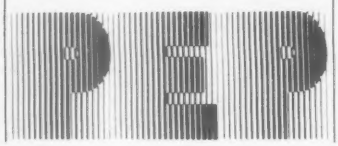

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